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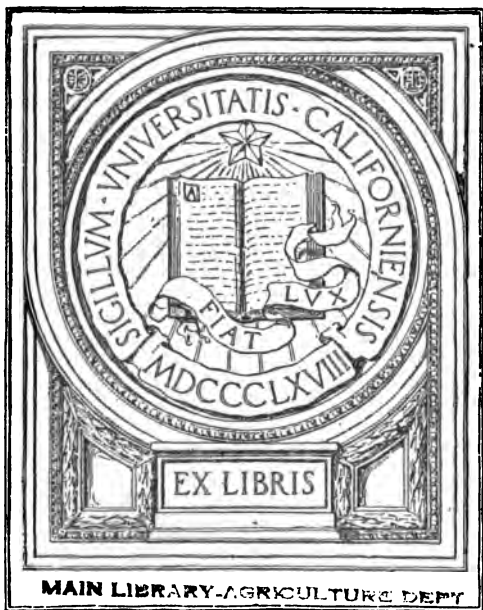
CABBAGES, CAULIFLOWER

— ETC. —

C. L. ALLEN

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CABBAGE

CAULIFLOWER *and*
ALLIED VEGETABLES

From Seed to Harvest

By C. L. ALLEN, *Author of*
BULBS *and*
TUBEROUS-ROOTED PLANTS

ILLUSTRATED

New York
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1901

TO YNU
ABSTRACT

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INTRODUCTION.

Gardening is an art, and he who produces the most and best from a given acreage is the most useful artisan. To be a successful gardener—and the term belongs to all who own or till the soil, no matter what the extent of the operations may be;—to get the best results from the labor of one's hands, certain principles and practices must be thoroughly understood. As these are alike in all branches of agriculture and horticulture, we shall endeavor to explain certain rules, and to state certain principles and practices that will be equally useful in every field, no matter what the crop may be, or to what extent it may be grown.

Fixed rules in agriculture cannot be laid down. While principles are fixed, practices are conditional; as, for instance, the time of planting is purely a local matter which every one must decide according to the conditions of climate; while how to plant, and what to plant, are principles applicable to all localities.

THE SOIL.

The first requisite for a good garden or farm is good soil; this is indispensable. Plants cannot, will not, reach perfection unless the conditions of growth are favorable. It does not follow that the soil must needs be naturally rich, it would be better if it were;

but plants do not live upon soil, they live in it, and partake of the food it contains. It therefore follows that if the soil does not contain the food the plant demands for growth, and the development of its fruits, it must be supplied; there is no alternative. The question as to the best kind of soil is an arbitrary one. Clay will be clay and sand will be sand; natural conditions must be accepted as we find them. But it does not follow that a naturally uncongenial soil cannot be made to produce good crops.

Our opinion, based upon the experience of many years, is, that the condition of the soil is of far greater importance than its character, and it is upon the former that success largely depends. A lively loam is undoubtedly the best soil for a garden; that is, it is congenial to a greater variety of plants than any other. Failing in this, we must make the best use of such as we have. Our experience and observation show conclusively that many unproductive soils, both heavy clay and light sand, are such from lack of proper tillage. Some of the most valuable lands under cultivation were, at one time, heavy wet clay, or drift sand. The former was restored by drainage and tillage, the latter by food and tillage.

The bulb lands of Holland, now worth \$3,000 per acre, are of the same general character as much of the pine lands of the Atlantic coast from Long Island to Florida, yet they produce enormous crops when liberally fed with stable manure. The very general opinion is that the difference in the cost of labor to produce a crop is more than sufficient to pay for the manure used on the sandy soil, where all the plant food employed is at once available. The delicate roots of the plants can easily penetrate the sandy

soil in every direction. At the same time the soil is pressed firmly around the roots. This is an important consideration, as they are so delicate that they will immediately perish if exposed to the air, as is frequently the case in heavy, poorly-prepared soils.

Another important consideration is that a greater variety of vegetables can be grown on light soils than on clay, and they will also be of better quality. There are but few plants that cannot be successfully grown on light sandy soils, while there are many that cannot be induced to perfect their crops on heavy, wet, clay soil.

On the other hand, a heavy soil has in it naturally more of the elements essential to plant growth; it has more recuperative strength, or reproductive qualities. With proper tillage and a systematic rotation of crops, the heavy soil will require but very little manure annually. While one plant takes from the soil certain active principles, it returns to the soil the elements that some other plant assimilates. Thus it is shown that by judicious rotation our land becomes richer rather than poorer. We do not mean to say that manure is not essential on heavy soils, but we do mean to say that there are essentials not to be found in the barnyard, nor in commercial fertilizers. These are to be found in tillage.

TILLAGE.

The most important factor in farm and garden operations is the preparation of the soil. This should commence when the ground is in the best possible condition for working. If it is a heavy loam, or clay, it should only be worked when it is sufficiently

dry to crumble into fine particles, by a persistent use of the plow and the harrow. Every particle of soil contains a given amount of plant food; in other words, all the elements that contribute to plant growth or development are found in the soil, and are acted upon by the elements in the atmosphere, brought down from the leaves by the sap to and through the roots. Here decomposition of the soil commences, and the result is the building up of the plant. These delicate little roots that perform this important work are of microscopical size and have not sufficient strength to penetrate a hard lump of earth; consequently they must fasten themselves to the outside of it. And, when the soil is left in a lumpy condition—as they cannot enter it—they must needs perish from without, as they cannot exist a moment if exposed to a dry atmosphere, which they must needs do when the soil is left in a lumpy condition before planting.

The soil, no matter what its character may be, is in the best possible condition for planting when there cannot be found in it a particle larger than a pea. The English and French gardeners fully understand the importance of this, and their method of preparing the soil with the spade is much more effective than ours, because their tillage is more thorough. Not that we cannot properly prepare the soil with the plow and the harrow, but because we do not. Our mistakes consist in not being thorough enough. Most of the tilth the soil gets during the season should be given before the seed is sown, or the plants are set; all that it needs afterward is to keep the surface, to the depth of an inch, constantly stirred with a fine rake or harrow. This is necessary to

prevent evaporation on the one side, and, on the other, to prevent the roots from coming to the surface. Roots naturally seek moisture, consequently they will point downward if the soil is light and dry above.

A still more important point to be considered in this connection is, that if the soil on the surface is light and dry that beneath will always be moist, and will not bake because there is no capillary attraction to the surface. The ground should be worked as deeply as possible, but the plow or harrow should never go below the soil; and it should not be fine on the surface and coarse underneath, but alike to the full depth.

A light sandy soil should be worked when rather wet in order that it may pack closely. The tendency with sandy soils is to become too open and loose, which allows the air to circulate through it and to carry off the moisture so essential to plant growth. As with heavy soils, the surface should be kept loose. Go over the surface with a rake or light harrow very soon after every rain, and more frequently if necessary. Do not cultivate to kill weeds, but work the land so thoroughly that weeds cannot grow.

To get the most and best from a given acreage, the plants must needs be set close. The soil is most productive when every particle of it is furnishing food for the plants growing in it. To that end, when it is properly prepared, the seed should be sown, or the plants set so closely that the surface will soon become covered. This prevents evaporation; it also prevents the soil from becoming too hot from the sun's rays. Between rows of plants that

require the whole season to mature, there should be one or two rows of some crops that mature quickly, so they can perfect their growth, and may be removed before their room will be required. Thus, an extra crop is secured, and the main crop will be increased because the extra crops do not draw as much moisture from the soil as the sun would. Neither does the soil suffer from becoming parched.

To get three or more crops from the soil in a year is what may be called intensive farming, which it is, and the only way farming can be made profitable; but this system of farming requires large quantities of plant food.

MANURE.

This should always be in readiness, and given the plants when required. Too much manure at a given time is not profitable; this is particularly true where commercial fertilizers are employed. It is far better to feed the plants two or three times during their period of growth than to apply the entire amount at one time. While it is true that where the ground is heavily manured for a first crop, a second one can be obtained—if of an entirely different nature—without any additional manure, it is equally true that each crop should have an application, however light, and this should be thoroughly incorporated with the soil before the seed is sown, or plants are set.

Much of the actual value of manures is lost in their application; much of it is put into the ground in such a manner that it is an injury rather than a benefit to the plants. It is a common occurrence to

see crops injured to a great extent by a too free use of commercial fertilizers, and in a test made with some of the leading brands, it was found that five hundred pounds to the acre gave better results than did a ton. In this trial the weather was an important factor, as will be seen by the following statement:

The fertilizers were largely put in the drills; and before the crops were half grown a period of rainy weather set in, so that the soil was completely soaked for more than a month. This rendered soluble all the fertilizers. The result was that the crops could not consume them. Drouth and extremely hot weather followed, which caused the caustic properties of the fertilizers to completely burn up the roots of the plants, where the large amounts were used, while the lesser amount proved a benefit.

No matter how little or how much manure is used, or whatever the character of it may be, it should be evenly and thoroughly incorporated into the soil and the soil made light by tillage so that the roots of the plants will find it all and use as much or as little as may be required.

Where land is constantly under cultivation, and is made to produce two or more crops annually, both barnyard manure and commercial fertilizers in equal values must be used liberally, and a judicious rotation of crops should be observed.

This system of cultivation, for other than cereals, has been found to be the only method that will make both the land and the owner rich. Many instances could be cited where the truckers near our large cities are making a profit of two hundred and fifty dollars per acre, and that on farms of two hundred acres in extent.

SEED BEDS.

Too much pains cannot be taken with the seed bed, although many crops are injured, sometimes ruined, by taking too much pains. The mistake comes from having the soil of the bed too rich, which has the effect of making the plants too succulent and weak. The seed bed should be carefully prepared, but not a particle of manure of any kind used. Let it be a part of the farm or garden, choosing an open, airy situation, and sow the seeds on a dry day.

WHY SEEDS FAIL TO GROW.

The general impression is that a seed must grow if planted, no matter when, how or where. Life in the seed form is persistent, and will manifest itself under great difficulties, but it cannot surmount all obstacles that oppose it. There are many reasons why seeds fail to germinate, or to grow after germinating; these are but little understood, and because they are not, failures are frequent, and the loss is attributed to poor seed when it should be charged to a want of knowledge of the requirements of plant life.

A frequent cause of failure is because the seeds are not sown at the proper time. Some kinds are sown too early, others too late. Seeds with a hard outer covering, like the asparagus, should be sown as early as possible in the spring, in fact, they would do better if sown in autumn, particularly if the soil is light, so that the winter's snows do not pack it down, as is the case with clay soils. Frost, or moisture, does not injure seeds of this character; on the

contrary, they will not germinate if put in late so that they cannot have the benefit of these influences, which would be fatal to other seeds. On the other hand, many seeds must not be planted too early; prominent in this class is the nasturtium, a seed that long retains its vitality when kept dry, but will not germinate in cold soil, hence the necessity of late sowing. To make success sure the requirements of each species should be studied.

Many seeds germinate quickly when sown, but the plants make a feeble growth, and the gardener cannot understand why he has such weak plants, when others of the same kind are strong, and that in soil not so rich in plant food. This comes from the manner in which the seeds are sown. It is a common practice in seed sowing to make the drills without first preparing the soil finely, the seed is then sown among the small lumps, and covered as lightly as possible, when it should first be made fine and then covered with fine soil, which should be pressed firmly around the seed. This principle has been well known and practiced for many centuries. One of the first elaborate works on farming, "Our Country Farm," published in France, 1616, says: "When the seed is sown let the earth be made very fine and press it hard over the seed with the feet." There is a vital principle in this method not sufficiently understood, but now generally practiced.

There is stored up in every seed a latent germ, the embryo of a new life, the development of which is conditional upon other natural causes. The influences that act upon the seed to cause growth are heat, air and moisture; and without a proportionate quantity of each there can be no plant life. Now, it follows

that when a seed is put into the ground and loosely covered with light, dry soil, it does not come in contact with sufficient moisture to soften its outer coating, neither is there sufficient heat, because of the too great circulation of air around the seed, to produce the chemical changes upon which vegetable growth depends.

Again, when we place a seed into the earth it immediately commences growth—when the conditions are favorable—in two opposite directions, upward into the atmosphere and downward into the earth, the two sources from which it obtains its food. It is a mistake to suppose that the first root the seed puts forth furnishes the young plant with food—it does not; it simply holds the plant in place until the true roots, by which the plant is fed, are formed. The first, or seed leaves, contain the food for the infant plant, to nourish it until its true leaves and roots are formed, and do not perform any of the functions of the plant.

The feeding roots of any plant or tree are delicate white fibers, so small as rarely to be seen with the naked eye, and are never seen by the casual observer. Now, when these roots are formed, if the soil is not pressed firmly around the main root, these feeders have nothing to live upon; they must come in immediate contact with moisture, or the warm, dry air will destroy them, and the whole plant will stand still until new roots are formed, or in the meantime perish. Hence the necessity of pressing the soil firmly around the seeds.

In thinning out the young plants, where the seed has been sown too thickly, the work should not be long deferred, but done before the second pair of

leaves has developed, and the soil pressed firmly around the roots of the remaining plants.

DEEP PLANTING.

This is another frequent cause of the seeds' failure to germinate, or to make rapid growth after sprouting. The importance of more care in this direction cannot be overestimated. Our observation and experiments made in planting various seeds at different depths show some astonishing results. Take, for instance, sweet corn, and, in planting, cover from one-half inch to five inches in depth. The former will germinate without a loss of five per cent., while the latter will not grow five per cent., and the exact ratio will be kept up. The cause for the difference is, that the conditions of growth are not complied with—the deficit being heat, which, at the season of corn planting, does not exist at so great a depth from the surface. Again, corn planted at a depth of three inches will not make as rapid or healthy growth as when covered only half an inch, and for this reason: Corn makes two sets of roots,—surface and underground—the one being quite as important as the other. The surface roots form just above the first joint of the plant, which is about an inch above the kernel. If corn is planted three inches deep, as soon as it has used up the food that is stored up in the kernel, growth ceases until a new and unnatural joint is formed at the surface, from which these aerial roots proceed. In planting corn in mellow ground, the hoe should never be used, the feet alone being the best implements that can be employed for the purpose.

When the corn is dropped, with the foot scrape sufficient soil over it to cover to the depth of half an inch, then step on the hill in such a manner that it will get the whole weight of the body, no matter how heavy it may be. This same rule will apply to the planting of most other seeds. Proper care in planting, and the too common practice of burying seeds is just the difference between success and failure in their germination and growth.

SYSTEMATIC ASSISTANCE.

The discouragements from trifling neglects are frequent means of letting the garden go to waste, when labor intelligently employed would add materially to the happiness of home by surrounding it by the beautiful and useful in plant life. No matter how pleasant home may be, how small the place allotted for the garden, climbing vines on the fence, or half a dozen tomato plants that can easily be grown, even in a city yard, will materially enhance them. Seeds sown with care, whether of vegetables or for flowers, will surely grow and add to the pleasures of the family.

There is not a seedsman in the land who is not, at one time or another, accused of selling poor seed, at least so far as its growing qualities are concerned. We have heard complaints from every quarter, heaped upon every seedsman's head, and while there are undoubtedly some causes for complaint, we earnestly believe that in more than 95 per cent. of the cases, poor seed means poor attention. In every locality there is always a man for whom every seed will grow—"a man of luck,"—there is also generally

to be found a woman for whom all plants will grow if she looks at them. In each instance may be found a person who understands a plant's requirements. It matters not whether this knowledge is innate or acquired; it is that which makes the plant grow.

To get the most from the land, at the least possible cost, has been, and is the great object and aim of the agriculturists of our country; and we wish to emphasize that we confine it to our country, as our methods are but little followed in other countries. "Keep the cultivator going," we are told, is the secret of success with cultivated crops. To keep the present "improved" cultivator going through field crops, as is now generally practiced, is not the secret of success, but, to a great extent, the cause of failure. While to keep a cultivator going, as it should be done, would be the secret of success, as is claimed.

We set cabbage plants for the heads they produce; tomato plants for the fruits they yield; we plant potatoes for an increase of their kinds. In either case, to get the desired results, we must have vigorous plants. We cannot have a large head of cabbage without a strong stem to support it; we cannot have a large yield of good, well-developed tomatoes unless we have vigorous vines; neither can we have a large yield of potatoes unless we have strong plants to produce them. This is cause and effect. Now where do the stem of the cabbage and the vines of the tomato and the potato get their strength? We answer, from the united action of leaf and root, the same as the trunk of the tree is built up in order that it may produce a crop of fruit. There can be no growth unless there is an equal amount of leaf force and root force. In other words, if you take

one-half the roots from the vines, they will have but half the strength required to do their work, consequently one-half the crop will be the result. That is just what the cultivator, as generally used, does.

To buy fertilizer to grow crops, then deliberately go through the field and destroy half of them is poor agricultural economy. But it is the common practice, and half-crops are the result. The object of cultivation is to build up the plant, in order that it may produce its fruits. Leaf growth and root growth must alike be encouraged; the means to that end are simple. The soil must first be worked deep and made rich, and the supply of plant food must be deep down to draw the roots from, instead of to, the surface which is to be kept stirred frequently, or just as often as necessity requires to keep it fine and loose.

The implement for that purpose is one that cannot possibly stir the soil to a greater depth than one inch. A simple one we have used is a heavy oak plank pierced with strong spikes, and this is kept going. Our best cultivators of cabbage have long since thrown away the cabbage plow, and, instead of working deep, work the surface only, and this with the best possible results. In countries where the crops are all worked by hand, which means surface culture only, the average yield of potatoes is fully double that of ours. Now, we do not wish to do away with the horse in agriculture, but do wish to have him attached to implements that will assist rather than destroy plant growth.

These preliminary remarks are applicable to the cultivation of all crops. Specific instructions will be given in their respective chapters.

CABBAGE.

The history of the cabbage, like that of most cultivated vegetables, is unknown. We only know that it has been in common use for more than 2,000 years among all peoples who have had vegetable gardens. The Dutch were the first known to have made a classification of varieties, and they did not multiply varieties to any great extent. The origin of the cabbage, however, is of minor importance compared with a knowledge of its cultivation, and the relative value of the numerous varieties, together with a knowledge of selection, which will enable the grower to improve upon the types under cultivation, and to develop new ones.

A knowledge of selection is so important to the farmer and trucker that it is necessary to speak of it as a principle in agriculture, in order, not only to show how new varieties have been secured, but how easily others can be developed by careful observation. In every field of grass, grain or vegetables, changes through climatic influences, or as results from a change of soil, are constantly going on. Sometimes in the line of improvement, sometimes the reverse. For that reason we shall speak fully and freely of selection in its relation to seed-growing, in order that every gardener and farmer may avail himself of the advantages that evolve through the

development of vegetable forms, from causes he may not know or understand.

SELECTION.

A familiar illustration of this principle may be seen in the history of the development of the cabbage. Changes in form, through climatic influences, are shown to have been greater in this than with any other vegetable. In a wild state the parent of our cultivated forms of cabbage has but few leaves, which are loosely arranged, but all that are necessary to protect the germ of the coming season's growth, which is to produce seed for the perpetuation of the species. When taken to a colder climate more protection becomes necessary. This is furnished by additional leaves, which are of a finer texture and more compactly arranged. The result of this care is the solid head of our present varieties of cabbage. From two or three distinct types introduced from Holland early in this century a large number of varieties, more or less distinct, have been produced wholly by careful, and in many instances systematic, selection.

To more clearly illustrate this principle let us note some of the points in the development of forms, where the cabbage is grown to the greatest perfection. Long Island, N. Y., is probably the most congenial home of the cabbage to be found in this country. Nowhere else is it so generally grown, or of a better quality, and here is where the greatest number of truly distinct varieties have originated. There is probably a greater variety of soil to be found in close proximity here, than in any other part

of the United States. On the one side is a heavy but friable loam, capable of producing enormous crops. On the other side the soil is of a light, sandy character, with but little recuperative strength. Intermediate is, in sections, a turfy and sandy loam, and beneath all is a gravelly subsoil, a condition best suited for cabbages.

In most countries there are certain districts and some particular farms which are famous for the production of some special crop and where the same is extensively cultivated. In such localities there are usually to be found some men who are leaders in their principal industry; they are regarded as authorities, and their advice is taken on all matters that pertain to their calling. This is the case on Long Island, in regard to the cabbage, where certain farmers possessing a remarkable degree of intelligence, and who are close observers and thinkers as well as workers, have made the growing of cabbage a specialty. These men have made selection, as a choice in regard to form and habit, a study. They have chosen for a purpose, either as regards earliness or lateness, or for the development of a desired form. Persistent labor and watchful care in this direction have been the means of producing the best strains or varieties of cabbage in cultivation.

While variations of climate produce wonderful changes in vegetable forms, it is a well-established fact that any vegetable grown in a given soil will assume a very different form when grown in either a heavier or lighter one. This has been shown in a remarkable degree with the cabbage. A given variety grown for a long number of years on a heavy soil, with a liberal supply of plant food, proper care

in growing the plants and in transplanting them, and constant cultivation until the crop is matured, will develop a type remarkable for size and vigor, with excellent keeping qualities, and be what is known as a Late Flat Dutch or Drumhead cabbage. On the other hand, take the same stock seed, grow it on a light, sandy soil, under the same climatic influences, with the same care in cultivation, always selecting with a view to earliness and solidity, and the result will be, in the same number of years, a variety of the same general form, but of smaller size, and very much earlier. Again, a soil intermediate in character, from the same stock, during the same period, with the same care in selection, will give a variety intermediate in character as well as in period of growth. Under such conditions have been produced the several varieties introduced from Long Island.

It is an established principle in agriculture that a sandy soil is favorable for an early growth, and a heavy soil for a continuous growth. Early and late, large and small varieties, are not to be expected from the same soil and under the same conditions of growth, both natural and artificial. It must, of necessity, take a longer time to grow a head of cabbage weighing twenty pounds than one half the weight. I have thus far spoken of the development of the cabbage by selection under natural conditions, but there are other methods employed by specialists. These are of an artificial character and have been material helps in selection. When these specialists harvest their stock seed, they examine each plant carefully before cutting it, and if the seed is of large size it is rejected, because they hold that such seeds

will make leaves instead of heads. Besides that these men will not use seed until it is at least three years old; for the same reason they will not use large seed. This statement corroborates the assertion that the conditions favorable for the production of the fruit are unfavorable for the production of a good quality of seed. We may, however, add that a handsome sample is not always a good sample, always excepting instances, as in the cereals, where the seed is the part consumed.

Local causes have more to do in forming a type than the efforts of all the horticulturists in the world combined. No one can change natural laws one iota, and they will control vegetable growth in spite of all that man can do. All the most scientific (and this means practical, for a man that is truly practical is absolutely scientific) can do is to work in harmony with the conditions of climate and soil as they exist. If a given variety does better on a certain soil than on another, that is the one to grow at all times, and in a locality where any vegetable form shows a tendency to improve, under good cultivation, there the seed should be grown to perpetuate it. And where any vegetable form shows, in the slightest degree, an inclination to deteriorate, even with the best cultivation, there the seed should not be saved to perpetuate the variety.

Probably more distinct types or strains of cabbage have originated on Long Island, N. Y., than in any other section in the world; and why? First, because cabbage succeeds best here; and secondly, because of the marked difference in soil in close proximity. Sixty years ago there were but three distinct varieties of cabbage grown there, viz., Flat

Dutch, Early York and Red Dutch, the two latter almost wholly from imported seed. The farmers that had been growing the Flat Dutch for the past 100 or more years were in the habit of saving their own seed, quite as much from economic reasons as for the improvement of type. In every town there was usually to be found a farmer who had an eye to business, he began to save seed for others than himself, and always selecting for this purpose the best heads. By this means, after a few years, he established a local reputation as a seed grower, which proved quite remunerative.

As before stated, on Long Island there is a great variety of soil, varying from a light sandy to a heavy loam, the north side, in its entire length, being the heavier, the south light, while the center is intermediate in character. Of course there are small patches of light soil to be found with the heavy, and the reverse; but the rule is as stated. Now on these different soils, the local specialists have developed three distinct types of the Flat Dutch cabbage: Early, intermediate, and late, and from these most of the popular varieties have been obtained.

We must here say that most of these growers selected for head only, which is very natural, as heads are what are wanted for sale; and how they would look as a type in the field, whether all the heads were very deep, or very flat, was of no consequence, providing each plant would make a solid head, fit for market. Some of these specialists, however, were more observing; they admired uniformity of shape, and they saw, too, that while a perfect head was desirable, a healthy and vigorous growth was essential for the preservation of the type,

as well as to render the plant more vigorous in winter, that is, to secure good keeping qualities. To that end plants were selected for seed purposes that had thick, smooth and perfectly shaped outer leaves.

One grower, whom we will mention as a type of the men who have rendered the country the greatest good in the selection of varieties, had this end constantly in view. For nearly sixty years this man made cabbage his specialty, but not for seed purposes. His object was to have the best second early cabbage in market, and to have it in advance of all his competitors. At that time New York and Brooklyn depended almost wholly for their cabbage upon Long Island and New Jersey, and the whole supply was grown within a radius of fifteen miles from the city hall of New York. Consequently, the man who had the earliest cabbage had the best market, and if he could have a week's sale in advance of his neighbors, he was the envy of all others, because his profits were greater than theirs. This man would never sell a seed, and but for his death this strain would never have been sent out, and the truckers would not have had All Head cabbage, which we consider the best Early Flat Dutch cabbage ever sent out. Of this there are already several synonyms, as every dealer feels it a duty to his business to have his own name attached to each variety he sends out, and in a sense he is right, and that sense is his care in selection. No matter how good a type may be, if the same care is not used in perpetuating it, as was given to establish it, deterioration will follow. So when the seedsman gives any variety his special care in selection he has a perfect right to prefix the variety with his own name.

The same rule holds good with the variety known as Stein's Early Flat Dutch, which was saved by another careful specialist, and in about the same way. This is a larger variety, is shorter stemmed, and not quite as early, and is exceedingly useful as a second Early Flat Dutch. This also has many synonyms, as we shall show later on.

In the origin of varieties we shall mention but one more in a special way, that one being the "Market Gardener's Private Stock" Flat Dutch, which was a selection made by a very intelligent market gardener who did quite a seed trade among the farmers of his section. His farm was one of the best on Long Island, and the soil was of the heaviest loam, which was favorable for continuous growth. For many years a careful selection had been made with a view of large and solid heads of good keeping quality. It was locally known as the Acme, and also Houseman's, from the man who had grown it for years.

GROUPS.

There are under general cultivation five separate and distinct groups of cabbage, viz., Flat Dutch or Drumhead; the conical or pointed heads; the Savoy; the Red; and the Danish or Hollander Ball Head. These are the parents of types, almost innumerable, variations in point of earliness or shape, which are either due to climatic influences or conditions of soil.

Types are only established by persistent effort in the line of selection, and that in a given locality, because if a change of locality is annually made, there will be a small but sure inclination for the plant to adapt itself to a new condition of growth. Some

kinds do this quicker than others. The cabbage probably will change less in one year than most other vegetables. When it has been grown for a long number of years in one locality its type becomes fixed, and will only revert back, or vary from the type formed, when grown under changed conditions, as slowly or in the same length of time as it took to establish it. But there is a point that should be well considered, viz., types will gradually change character in proportion to the change there is in soil and climate. As an instance, if the seed has been grown for a series of years in a comparatively cold climate, where the season of growth is short, and then is taken to a warm climate, where there is but little, if any, winter, the type would be lost with the first year's crop of seed. For that reason cabbage seed that will reproduce solid heads cannot be produced in warm countries.

SOILS AND SITUATIONS.

The question is often asked: Can cabbage be successfully grown in all soils and situations? To which query we reply: Yes, as readily as any other vegetable, and in most localities it is a very simple matter. But the conditions favorable do not always exist, and experiment alone will teach the important lesson. It was supposed, but a few years ago, that a clay soil was not suited to the cabbage, and no special efforts were made to grow it on such soils. But now, in localities where it was then thought impossible to grow cabbage at all, it is a profitable crop at \$5.00 per ton delivered to the cars. In such localities, growers have learned by experience that

different methods must be adopted from those practiced in other places.

The favored land for the cabbage is a lively loam, with an open, gravelly subsoil, and near the seacoast; such situations were formerly sought, but when such soil could not be found to the extent required, other soils were tried, and after a few experiments just as good success was obtained. In light soils it is better to plant the early varieties, as they mature more quickly, and a light soil does not like to be slow in its operations. If we wanted cabbage for fall or winter use, and our soil was of a sandy character, we should invariably plant the early sorts, but should sow the seed at least three weeks later than we should the late varieties. This is a point often overlooked. Quick-growing varieties of any vegetable are better for light soils than late varieties. Hence the importance of ascertaining by systematic experiment, what is best for our soils.

CONDITIONS OF SOIL.

There is one important consideration in the growing of all crops: How to get the most with the least possible expense. The question of soil being an arbitrary one, we must, of necessity, use what we have, and it is not at all times possible to have it in just the condition we would like. This is particularly true with small farmers, who are obliged to keep all their soil under cultivation. Cabbage can be grown more cheaply, because, in part, the crop is more certain when planted on new or sod ground. For an early crop this should be plowed not later than the first of October—a month earlier would be

better ; harrow thoroughly as soon as plowed, in order to prevent the grass from growing in the open spaces between the furrows, and also to assist in the rotting of the sod. As early in the spring as the soil is in proper condition to work, scatter broadcast five hundred pounds of high grade fertilizer, or a liberal application of well-rotted manure. If the sod is rotted as it should be, it may be cross-plowed to good advantage, or the fertilizer may be worked in with a disc harrow.

For a late crop, plow the first week in June, and treat in all respects as for an early crop. Put on the manure more liberally than for a spring crop, say 1,000 pounds of fertilizer to the acre, or all the well-rotted stable manure at command. There is but little danger of getting too much, as the cabbage is a gross feeder. Let the soil be worked well, for strong as the cabbage may seem it does not make a good growth in poorly prepared soil.

Early plants may be set as soon as the soil is in good working order. Do not be in haste, as wet ground can only be worked at a loss; do not be behind, as lost time is never found.

For early cabbage, we should invariably use the Early Wakefield; the seed of which is best sown about the first of September, not later than the 10th. Sow in drills, thinly and keep well worked. Between the 15th and 20th of November dig a trench six inches deep and a foot in width, as long as necessary, take up the plants carefully and place them upright in this trench, roots down, scattering a little soil around the roots as they are put in; pack them closely together, but not so firm as to bruise them. When the trench is filled cover with two boards in

the form of an inverted V (Λ) then over this plow a furrow from either side, so that the soil will be about six inches deep over the boards. It is best to put a small wisp of straw upright between the boards, reaching above the soil; this will carry off all the warm, moist air from below, which is constantly rising, and prevent the plants from rotting, which they are apt to do if they get too warm in the trenches.

The plants may be set sixteen inches apart in rows thirty inches apart—this would be for a regular farm crop, and the market gardener or trucker, adjacent to a large city, where manure can be obtained without cost, except for hauling—then between each plant, and between each row lettuce may be set about eight inches apart. This will necessitate hand cultivation which is economical where land is very dear, The lettuce may be taken out before the space will be required for the cabbage. Keep the plow or the hoe going, not to kill weeds, but so constantly that weeds cannot grow.

For a succession use the Large Wakefield, which will come in about a week, or possibly two weeks, later. The seed of this should be sown in the same way, at the same time, and wintered over in the same way as the Early Wakefield.

This method of wintering plants is far better and much cheaper than to winter them in cold frame or greenhouse. They come out of the trench perfectly healthy and start immediately into growth, making heads fit for market in forty days from the time of planting.

For a second early crop we recommend "All Head," it being as early as any we have tried, and

absolutely sure to head. The seed of this should be sown by the 20th of February in the greenhouse or hotbed; sow the seed thinly, and do not hasten growth too much; let the plants come on as though grown in the open air, give them all the air possible, when the temperature will permit it, and the plants will be sufficiently strong to be put out by the middle of May, and will come rapidly forward.

It may be asked, why not grow these plants and winter them over the same as the Wakefield. If so, we will say, we have tried this plan repeatedly with the early Flat Dutch varieties and have never been successful. They are quite apt to run up to seed instead of making heads, and when they do head, the check they get seems to break them all up, and they grow into almost every conceivable shape. We have wintered the late varieties with good success, but it is no object to get them in this way, as they are not wanted for summer cabbage.

FALL AND WINTER CABBAGE.

The seed for these is sown from the first of June to the first of July. First we use an intermediate type, and for this we prefer the Stein's, which will be ready from seed sown June 1st (and available for cutting by September 1st), and we should sow seed at intervals of a week until July 1st, when we put in our latest variety, this latter largely for putting away for winter.

Where sod ground cannot be had for a late crop, nearly equally favorable conditions can be secured by planting after early potatoes, providing there is no delay in getting the potatoes off (which can be

done by the 15th of August), early enough for late cabbage, if the intermediate strains are used; and this we should, by all means, advise—as they will keep over winter as well as the later sorts, if not allowed to get overripe before putting away. All cabbage to keep well through the winter should be put in trenches before the outer leaves begin to drop; if put away when the heads are two-thirds grown they will perfect their growth during the winter.

Good cultivation is the secret of success in growing cabbage, it matters not what the variety may be, whether an early or late, large or small crop. From the time the seed is sown, until the heads are fully matured, constant attention will be required to secure a crop.

THE SEED BED.

The first step to be taken in the production of cabbage is to secure the plants, and it is one of the greatest importance, in fact, all-important, as good cabbage cannot be produced without good plants. We wish to impress on our readers the importance of having the very best plants it is possible to obtain, having so frequently witnessed the failure, or partial failure, of crop due wholly to the use of plants improperly grown.

The seed bed should be as far removed from the borders of the field as possible, particularly if the borders are hedgerows, which are the breeding places of grasshoppers and other insects injurious to vegetation. It should be beyond the range of farm poultry, the plants' worst enemy. The character of the soil is second in importance to condition

No matter whether it be a heavy loam, or light sand, before the seed is sown it should be reduced to the utmost possible fineness. But it should not be made rich. In such ground the plant grows too quickly, and in consequence is succulent and weak, and has not the strength to withstand the shock attending transplanting. A soil made rich for a previous crop would be the one best suited for the production of plants. After the soil is thoroughly pulverized, make the surface firm and smooth by the use of a roller, or if that is not convenient, firm it down evenly and firmly with the back of the spade.

Make drills six inches apart across the bed—which should not exceed four feet in width—with the edge of a board, which should have the corners taken off. Such a device will make a trench one-quarter of an inch wide at the bottom. Sow the seed thinly, say from four to six seeds to the inch. Then wet the drills thoroughly.

From the plants' first appearance in the seed bed, they should not receive the slightest check until the heads are perfected. As soon as the young plant breaks through the ground, some insect is ready for attack, and will contest its growth, the first being the black flea, which will destroy all the plants in a day if they are not protected. The best remedy we have tried is tobacco dust, which should always be in readiness. The first application should be in the drill when the seed is sown. After sowing the seed, cover it thinly with the dust, then, if it can possibly be obtained, cover to the depth of one-quarter of an inch with fine white sand; this will retain the moisture from below and will not bake and prevent the plants coming up. If sand cannot be obtained, cover

with the same soil as the bed; in which case the bed should be shaded with some light brush or any convenient cloth covering. When the seed leaves are fully developed, give them a slight sprinkling of tobacco dust, whether the flea is in sight or not, and follow it up immediately after a shower, and until the plants have made two or three inner leaves, or are nearly large enough for transplanting.

By this method better plants will be secured than are usually obtainable. But there is a still better way, which those practice who have cold frames, or hotbeds, in which they start their plants. As soon as the plants have perfected their first leaves, which will be within forty-eight hours after breaking through the ground, they are pricked out into beds prepared in the same way as recommended for the seed bed, in drills one inch apart and half an inch apart in the drills. As soon as these plants have made their second pair of leaves and show plainly the third pair, they are again pricked out, in the same manner as before, only they are set one inch apart in the drills.

It is a common and very excellent plan to have shallow boxes, usually two and one-half inches in depth, filled with fine, and a little richer, soil than that first used, and prick the plants into these. These boxes are then placed in cold frames where they can be shaded for a day, and protected from cold, drying winds when necessary, which is highly important for early crops. Anyone who has once adopted this method will never go back to the old method of starting plants. The reason is obvious. Plants grown in this manner form a solid mass of roots, instead of one long spindling root, with a few root-

lets, and when taken to the field in these boxes they can be set quickly and without the loss of a single plant, or the slightest check to their growth.

The average farmer or trucker is not ready for such a radical change of methods, the objection being the want of time, as this work must needs be done at a busy season. To meet their objection, let us say that at the most this method requires but a day's extra labor for an acre of plants when set, and much of this can generally be done under cover on rainy days. But suppose it could not, labor is not lost when well applied, and, when plants are grown in this way, and carefully set in the field, the plants will perfect their growth, and the cabbage be ready for the market at least two weeks earlier than when grown in the usual manner.

There are several farmers on Long Island, within ten miles of New York city, who grow, annually, one hundred acres of early cabbage, cauliflower and other vegetables, whose plants are all grown in this manner, and who could not be induced to grow them in any other way, on the score of economy. By this method a second crop is secured, and in some cases a third. A saving of two weeks in June means a crop of spinach in October, which makes the third in rotation, and which would not be possible under the usual methods.

PREPARING THE SEED BED FOR LATE PLANTS.

The preparation of the seed bed for late cabbage and cauliflower plants should be undertaken as soon as the soil is dry enough that it can be worked fine. After plowing, use the harrow, and make the

soil fine to as great a depth as it has been plowed. A day spent at this work is labor wisely employed. After the harrow has finished its work, put on the roller, making the surface as smooth as the house floor, then cover to the depth of four inches with coarse litter from the stable; or seaweed, if it is easily procurable; or any convenient mulch that will prevent evaporation.

The benefits arising from this method are many fold. In the first place the work is done on time and the bed will be in readiness for the seed when wanted. In the next place the soil will at all times be moist underneath the mulch, so that the seed can be sown at the proper time, no matter how dry the season may be; and there will always be moisture enough in the soil to carry the plants until they are sufficiently large to transfer them to the field where the crop is to be grown.

There is another important consideration which must not be overlooked. Moisture is constantly rising from below, and, when prevented from evaporation by the mulch, it must be retained, and to as great a depth as the soil has been worked. At the same time all the small lumps will become so completely pulverized that the soil will be to the touch as soft as the finest sand, and fully charged with sufficient plant food.

Remove the mulch when the seed is to be sown, then proceed as we have already stated. We would again urge the importance of covering the seed with fine white sand to prevent the soil from baking, as well as to prevent evaporation. We have found no better covering for the seed bed after sowing than

the "excelsior" so much used for packing. If put on to the depth of two inches, the plants will be well up within three days from the time of sowing, then remove the mulch and keep the soil constantly stirred between the rows.

TRANSPLANTING.

Having secured good plants, by whichever method grown, the next important step is to transfer them to the field or garden. In reality this is *the* all-important work, for upon it depends, in a great measure, success or failure. It matters not how good and pure the strain of seed sown, or how good a start the young plants have made, if they are not properly planted, total or partial failure will be the result. It is, therefore, important to exercise the greatest possible care in transplanting, and it should always be done when the conditions of growth are the most favorable. We have given this subject very much attention, as we must needs do in growing, for seed purposes, more than one hundred acres annually. Our experience has taught us conclusively that the most unfavorable time for transplanting is immediately after a heavy rain, the time usually selected for the work; while the most favorable time is just before a heavy rain. As this cannot always be determined, the safest, hence the most economical, plan is to plant on a cloudy and not very hot day, and that day the one when the plants are of sufficient size, which is when they have made three pairs of leaves. If the seed has been sown thinly the plants will be about four inches high and very stocky.

The ground in readiness, take up the plants

carefully, so that their delicate fine roots are not in the least broken or bruised; if the soil in the seed bed is quite dry all the better, as it will then fall away from the roots without injuring them. Lay them carefully in a shallow box or basket, water them thoroughly and cover with a piece of wet cloth to prevent evaporation, which the sun and air would rapidly encourage, and if not checked would soon ruin the plants. When set they should be puddled in, and for a field crop to do its work profitably, three persons' aid is required. To do a work well is the only proper way, no matter what it may be, even though at the start it may seem to be more expensive. When the ground is marked off, one person (a boy would do as well as a man) goes ahead, makes a hole with a dibber and drops the plant in it. In this work care should be taken not to make the hole too deep. The second person pours into the hole one-fourth of a pint of water, and the third packs the wet soil, or mud as it should be, firmly around the roots, then covers the surface with loose, fine soil to prevent evaporation.

We have tried this method repeatedly; in fact, in late years, we have employed no other, never losing a plant, except it be by insect or accident. And what is still more important, the plants are no-wise checked, growth commences immediately, and success is assured. We would like to impress upon every cabbage grower (and the same method should be pursued with every other plant) the importance of this method sufficiently to give it a trial, and compare the results with the ordinary method of putting the plants in with a dibber after a rain.

Cabbage and cauliflower, more than any other

plants, are injured by a check in transplanting. Plants set just before a heavy rain, in the ordinary manner, will not receive a serious check because the earth becomes so thoroughly packed about them that the air cannot reach those delicate feeding roots which are essential to the plant's existence and growth. The moment these become injured in any way the plant ceases to grow, and cannot renew its growth until new feeding roots are formed. The plants set when the ground is very wet are apt to receive injury from the roots drying off, because the farmer in his haste to finish his work, while the soil is wet, does not take sufficient time to press the earth as firmly around the roots as he should. By puddling the plants this risk is avoided, and the work cannot be done without being well done. If there is no fear of an approaching shower, undue haste is not necessary, as this is the enemy of systematic work.

The principal objection made to puddling in plants is the time required to do it, which at the season when the work must be done seems doubly valuable. We will quote one of the many instances that have come under our observation to show that time spent in puddling in plants is wise economy. Two brothers each put out two acres of cabbage for seed purposes. As their farms joined and an interchange of labor was their custom, one of the brothers prepared a seed bed sufficient for both. As the cabbage was of the same variety, and the seed produced was to go to the same party, this could be safely done.

When the time arrived for putting out the plants, and as there was every appearance of a heavy shower, the work was commenced with vigor. By

the time one field was set it rained so hard that the work had to be suspended. The storm proved to be of unusual severity, lasting for nearly two days. The result was that the rain packed the soil more firmly around the plants than it was in the original seed bed, and there was not the slightest appearance of wilting.

After the storm was over, the second two acres, which were directly opposite, having soil of precisely the same character, and prepared in the same way, were planted. The ground was as wet as it could possibly be and the plants were put in with the dibber in the usual way. A severe drouth with high drying winds followed the setting of the plants, and, as the soil had only been pressed against the roots, not firmly packed around them, the new feeding roots in many instances could not take hold of the earth, consequently they could not convey food to the plant. What was the result? The field that was first set had a crop that was as good as it was possible to grow—in fact, it was absolutely perfect. The second piece, because of the check the plants had received, was a total failure. This check gave them sufficient rest to start into seed growth, but as they were not large enough for that they made an abnormal growth, and the field presented nearly every type to be found in the cabbage tribe. The party for whom the seed was grown was, of course, disappointed, but not astonished, as it was his second experience of the same character.

DISTANCE APART.

How close should cabbages be planted? is a question often asked, even by those who grow them

largely. This is not strange when we consider that there is a great difference of opinion among growers on this point, a difference that comes from the different methods of farming. One farmer will grow 7,000 heads to the acre, his neighbor will grow 11,000 of the same and get just as good, if not better cabbage. This marked difference seems strange—it is strange—but it is easily accounted for. In the one case the plants are set sufficiently far apart for the cultivator to do all the work required; in the other case they are set so that the cultivator and hoe both are used, in working the ground. More than this, the number of heads that can be cut from an acre depends largely upon the fertility of the soil. It costs more to feed 10,000 than it does 5,000, no matter what it is we feed, whether it be plant or animal.

Under a system of intensive farming, which gives the plants all the food they can possibly assimilate, and permits no barren waste between the rows, and where all the cultivation is done by hand and with a narrow hoe, the crop per acre will be more than three times as large as where the land is worked in the ordinary way. This may be seen by the way the systematic trucker does his work. For example, we will take the Early Jersey Wakefield variety; this is set in rows thirty inches apart and the plants one foot apart in the row, which gives 17,424 to the acre, and if the seed is a carefully selected strain, such as the market gardener seeks to obtain, and the plants are set under favorable conditions, there should be sold from the acre 17,000 heads, which is a much higher percentage than can be had when grown by the ordinary method.

To give a clearer idea of the amount to be obtained from an acre, and why there is such a large percentage of heads, we must give some of the details of cultivation, which will also show the soil's capabilities of production. Between the two rows of cabbage plants, and alternating with the cabbage in the rows, lettuce plants are set, which gives about 35,000 heads of lettuce to the acre. This makes the rows of plants one foot apart, which seems to require considerable from the soil. But the gardener is still unsatisfied, because experience has taught him that the soil will honor every reasonable demand made upon it, providing the plants have sufficient room for development. He, therefore, sows a row of radishes between the rows of lettuce and the rows of cabbage and lettuce. Now the plants are but six inches apart, which is about all he can or does expect; he is satisfied, so is the soil, for it has all it can do without growing weeds.

There is a great benefit to be derived from this method besides the amount obtained from a given acreage; the soil is at all times just sufficiently shaded to prevent evaporation through the sun's influence, and the soil is kept cool and moist, which are the requirements for tender vegetables. The moisture that comes from below is caught up by the plants, and it cannot well escape. When this method is adopted the seeds must be sown thinly, or the plants thinned out to the proper distance apart before they have formed their second pairs of leaves. The radishes should be thinned to about four to an inch. In three weeks these will be ready for use, and not a moment is lost in getting them to market. The lettuce then begins to require the room the radishes

occupied, its roots have gone deep down, and the heads are forming. Another week, they begin to give way to the increasing forms of the cabbage, and they in turn are marketed. This leaves the cabbage the sole occupant of the soil, and it requires it, as the heads begin to form and the outer leaves are expanding to give the head the room it needs, no less than to shade the soil and protect it from the sun's burning rays, than which there is nothing more injurious.

It can be readily understood that when such demands are made upon the soil, it will, in turn, demand sufficient nourishment to produce such results. But the food it gets is but one of its requirements. It asks to have its surface kept clean and fine, in order that weeds cannot grow. The plants, too, assert their rights, and say if we are expected to produce large heads we must not have our roots disturbed, upon them we depend, almost wholly, for support. The gardener responds, and from the time the cabbage and lettuce plants are set, and the young radishes appear, no implement is used, other than a small hoe, about four inches in width. By the middle of June the cabbages are marketed, the soil is again enriched, and another crop comes on in strict order of rotation.

PLANTING THE SEED WHERE THE CABBAGE IS TO GROW.

It is a common practice with New England farmers to sow the seed with a drill, and where the plants are to grow, a plan we highly recommend, having tried it many times with the best possible success. Last year several of our truckers lost a large

portion of their plants by drouth and cutworms, and as they could not replace them, they resorted to this method, which proved so satisfactory that they will hereafter put out all their late cabbage in this way. We will state one instance: A neighbor was short of plants, having only sufficient to set three-fourths of his field. He used the drill for the remainder, sowing the seed the same day he set his plants. The seed drilled in came up quickly, the plants grew rapidly, not having any check, and matured their heads several days in advance of those from the transplanted plants. So much more vigorous were they that this part of the field appeared like a more vigorous variety.

Had the plants set out been pricked out once or twice before planting in the field the result might have been different; as such plants, when properly set where they are to remain, are not apt to receive a check. It is, however, a quicker and easier plan to sow the seed where the plants are to remain. It is not only more expeditious, but the work can, and should, always be done on a pleasant day, while the plants must be set on a wet day, or, as is usually the case, immediately after a heavy rain, while the ground is wet, and the work the most disagreeable the farmer has to do.

Any seed drill may be used for this purpose by stopping up most of the holes in the wheel, so that the seeds will drop as far apart as the plants should stand. This will leave but little thinning out to do, as there will not be more than two or three seeds dropped in a place. In thinning, if any of the plants show remarkable vigor, they should be the ones to be thrown away, and leave such only as have fine

mid-ribs, the leaves smooth, indicating health without grossness. A very rank plant—one that is in advance of the others—is usually in the line of deterioration.

If, at the time of sowing, the ground is dry, it should be thoroughly rolled and made as fine as possible. After sowing go over the rows with a roller to press the earth firmly around the seeds. If a roller is not at hand, go over the ground with the feet, which is the better, because the most convenient, plan for all small sowings. It is always better to sow the seed when the ground is dry, because it will pack too hard if rolled or tread when wet. The safest way for the cabbage grower is to have a seed bed ready in either case, so that plants can be had, if required, in case of accident to those sown in drills. Sometimes drouth or insect enemies will destroy the one and not the other.

Where the seed is sown in the rows where the plants are to remain, all manures must be thoroughly and evenly incorporated in the soil. We do not advocate putting the manure in the drill, whether it be from the stable, or in commercial form. On the contrary, put on broadcast and have it worked in deep. The plants will be sure to find it, and it is a much better plan to let the roots extend in all directions than to have the plant food all in one narrow drill. The cabbage, more than most other vegetables, requires to have its roots extend in all directions for the support of the plant, and, when a moderate supply of plant food is found in all the directions the roots follow, and a double purpose is accomplished, the plant increases in size and strength.

HOW MUCH SEED PER ACRE?

This is rather a difficult question to answer, and for many reasons. Some seed, or rather the seeds of some varieties, are much larger than others, as, for instance, the seed of the Wakefield is nearly double the size of that of some of the Flat Dutch varieties. Then some seed has a higher power of germination than others. Again, much depends upon how the seed is sown. If sown very thickly, as is most generally the case, the strong plants will crowd out the weak ones, even when very young.

Of most varieties there are about 10,000 seeds in an ounce, but, as seeds are usually sown, 3,000 plants is all that can be expected from an ounce of seed. But if the seed was sown thinly, and the plants were well cared for, and in soil properly prepared, 5,000 plants could easily be gotten from an ounce of seed. When sown with a seed drill, and the plants are to remain where the seed is sown, much thinning will be necessary, so that eight ounces per acre will be required.

ROTATION OF CROPS.

How often can we return to the same field with a crop of cabbage? is a pertinent question, and one frequently asked. This depends largely upon circumstances. The character of the soil, as regards recuperative strength, will have much influence in this respect; but the character of the rotation, and how fertility is kept up, exert quite as great an influence. It is generally supposed that if we grow cabbage more frequently than once in three years it will

club-root. This may, or may not, be the case, but observation teaches us that club-root will appear in parts of fields where there has not been cabbage in twenty years. We saw a case of this kind last season, where a farmer had a field of several acres, one side of which was lower than the main part of the field; on this side the whole crop club-rooted, not a head escaped. He said there had not been a crop of cabbage grown on any part of that field in more than twenty years.

Yet many market gardeners, near New York, have cabbage on the same field fully half of the time, and some of the more experienced say that if lime is used freely it could be grown every year on the same ground, while others say they must give up growing cabbage, as their land will no longer produce it.

We are of the opinion that one crop, when well grown, not only perfects itself, but at the same time prepares the soil for some other crop. In other words, where early potatoes are followed by a crop of late cabbage, the same rotation can be kept up for a succession of years with impunity, bearing in mind the importance of soil fertility. The cabbage is a gross feeder, and the potato equally so, it therefore follows that the two crops must annually take from the soil a vast amount of plant food. A good crop of each takes from the land fully thirty tons of stable manure. No two species of plants have identically the same wants, or possess the same powers of supplying them from the soil. From the one crop there is always something left for the other. Rotation of crops, with a liberal amount of well-assorted plant food, is the secret of agricultural success.

THE VALUE OF LIME.

In cabbage and cauliflower cultivation, lime is indispensable. One of the largest growers in this country attributes his success to the use of lime. He grows annually sixty acres of cauliflower and nearly as much of early cabbage. When he sets his plants, he puts a handful of shell lime around each plant, and he never has club-root or stem-rot. The lime touches the plant and covers the ground in a circle of about four inches in diameter, and it remains on the surface until after the first hoeing, when it is lightly covered.

CULTIVATION.

As soon as the plants are established the cultivator should be set at work in the field, and the hoe in the garden; not only should they be set at work, but kept at work, as steady, persistent labor in cultivation is the price of the crop. The soil should be worked deep before the plants are set, but shallow cultivation afterward is all that is required; in fact, more cabbage is injured by disturbing the roots with the small plow than is generally supposed. Keep the surface soil at all times fine and light, which will prevent evaporation, at the same time keep down all weeds, and the secret of successful cultivation is discovered.

In many of our best cabbage-growing districts, the small plow, that was formerly considered indispensable, has long since been discarded, and the wheel cultivator is no longer doing its deep work. The truckers or market gardeners, who have small

farms have never had need of these, as the plants are set so closely that the horse and cultivator could not go between the rows.

QUALITY OF CABBAGE CHANGED BY CULTIVATION.

There is no vegetable so changed in its essential character by cultivation as the cabbage. To be tender and sweet it must grow quickly; to grow it quickly, the plants must be healthy when set; the soil must be properly prepared, and all the conditions of rapid growth strictly observed. If grown slowly the inner leaves will be tough, and of strong flavor, which renders them entirely unfit for salads, and by no means so delicate when cooked. The cabbage grown in Europe when brought here takes double the time to cook that ours does, and the flavor is strong and unpleasant. There is another important point often overlooked: Cabbage is never as good as the moment it is cut in the garden; wilting toughens it, its fibers grow hard and no amount of cooking will restore its natural tenderness.

In the garden a succession of planting is as necessary for cabbage as for any other vegetable. The moment a head reaches perfection it begins to deteriorate, hence the necessity of a succession in order to have it all times in the best possible condition.

For winter use we prefer the putting away of heads not quite fully grown, such will complete their growth in the trench during winter, and they will be more tender and delicate than those fully matured in field or garden. All vegetables are more delicious when young, from the fact that the fiber which affords the plant strength to produce a seed

crop is not yet formed. This fiber is not only tough, hard of digestion, but in some plants actually injurious when used as a vegetable. Many persons can eat cabbage when taken fresh from the garden, young and tender, but cannot eat it after it is fully matured, and has been stored for a short time even, as it is then not only tasteless but indigestible.

TO KEEP CABBAGE THROUGH THE WINTER.

This is a simple matter, although there is quite a difference of opinion as to the best methods. The market gardeners near New York plow a single furrow from six to eight inches deep in which they place the cabbage, heads down, as closely as they can be set; they then turn a furrow over the heads from each side. This is all the attention that is required, as they will be covered to the depth of a foot, which is quite sufficient to keep out all the frost we are liable to have before the heads are marketed, which is usually by the first of February. The heads put in these trenches are always fully developed, as they need to make no growth during winter when put away in this manner.

There is a better and more simple plan than this, where it can be adopted. Where cabbage is grown for shipping in large quantities, the farmers keep it in their orchards, or in groves, where there is slight natural protection. It is best to commence against a fence with a southern or eastern exposure. The fence is made tight by a liberal use of straw, or stalks, or both; against this are set the cabbages as grown in the field, upright, but with a little slant, and placed closely together. When a row of the

required length is placed, another row is placed above them, the stems being arranged between the heads of the first tier, so that the heads of the second tier rest upon the tops of the first. Then another tier is added in the same manner. In this way the operation is continued until the crop is put away, when the whole is covered with newly-fallen leaves to the depth of three inches. The leaves are kept in place by sprinkling a little soil over them, or with brush, boards or old rails, in short by whatever is most convenient. Wherever salt or marsh hay or seaweed can be obtained they can be used to advantage in place of the leaves. Where cabbage is grown on a large scale there is no way yet found more economical, or one that will better protect the cabbage from loss, or keep it in better condition for eating as well as shipping.

Those who follow this plan usually select the smaller or not fully-developed heads, to be the first put away, as they will continue growing during the winter, so that heads not fit for market in November will sell readily in February.

The time for putting away cabbage for winter shipment is a local matter, depending wholly upon climatic conditions. There is but one rule to govern this matter, and that is applicable to all situations, viz. : Cabbage should never be put away when wet, or handled when frozen. It is better to leave it in the field as long as possible, but far better to take up a week too early than a week too late. Select a day best suited for the work, and leave the covering with leaves as long as possible. Cabbages will almost invariably rot if bruised when frozen.

Should a field of cabbage not perfect its growth, that is, not make marketable heads before it is time to put away for winter's sales, we should advise a different way of keeping them through the winter, which is the same plan we adopt for putting them away for seed purposes; a plan that will secure a crop that the grower would only consider valuable for stock feeding. Plow out a double furrow, going forward and back in the same place. This will make a track sufficiently wide for three rows, one on each side and one in the center, the latter resting on the other two, the heads sinking about one-half their depth between the former. They should be placed roots down, and at the angle a head would naturally lie when pulled up and laid upon its side. The heads should be taken up after a frost, as is best in case of putting them away when fully grown, but never badly frozen. As fast as the heads are placed in the trench, cover the roots with earth and pack firmly over them.

After the heads are intrenched, leave them exposed as long as they are safe from freezing, then cover to the depth of three inches with soil without straw or any other protection. This is best done by running the plow on each side of the row and throwing the furrow over them. This will be sufficient until appearances indicate that winter is to set in in earnest, then cover with at least a foot of earth and leave them for the winter. It is best to have breaks in the trenches as often as once in forty feet, and in the center of each it is advisable to put in a wisp of straw for ventilation, in case of a mild winter. After the covering of soil is hard frozen, say to the depth of three inches, the trench should be cov-

ered with stalks, leaves, or whatever material is most convenient, to prevent further freezing, so that the heads can be taken out as required. It is not good economy to lay aside as worthless a lot of cabbages because they are small. If put away as recommended, they will make fine heads before spring, when they will be worth more than they would have been had they perfected their growth in November.

CABBAGE FOR FAMILY USE.

This should be put away in the same manner as that for market, only that the heads put in the trench first, and which will be the last to be taken out, should have their heads but perfectly formed, just large enough to show that the possibilities for a head are there. These should be followed by more matured heads, and the last put in should be fully developed. Where poultry is kept there should be sufficient put away in the same trenches to give them an occasional meal.

TYPES AND VARIETIES.

As already stated, there are five distinct groups of cabbage in cultivation. In some of these there are variety names, almost innumerable. Some are descriptive, as, for instance, for earliness, lateness, as may seem desirable; others for general adaptation, as "All Seasons," "Succession," or "Surehead." Others have a local application, "Louisville Drumhead," "Bridgeport Drumhead," or "Long Island Beauty." On Long Island there are numerous local names for the various strains which are rarely known

under the grower's name beyond the immediate locality where the selection of a given type was made, and which bears the grower's name.

The growers of many of these strains which have a local reputation were painstaking men; they were also men of keen discrimination. They could detect slight variations in habit of growth, as regards size and solidity of head, vigor of constitution, which would make it valuable for its keeping qualities, or for a tendency to produce large heads with but few outer leaves. All of these characteristics were of importance to those who grew cabbage on a large scale for market purposes. These men became famous, in their respective localities, as seed growers, and annually saved and sold at an enormous price large quantities of seed. There are many instances where men made more money from the product of one-quarter of an acre of cabbage, grown for seed, than from all the products of a hundred-acre farm, because of the high price they obtained for their seed.

Among the number was a Mr. Vandergaw, whose selection was generally known as the Vandergaw cabbage. This particular type was never known to the trade until the writer obtained a stock to grow for seed purposes, for the trade. Its usefulness as a variety for early, intermediate and late planting was soon recognized, and James J. H. Gregory immediately secured the whole stock, which he sent out as a novelty, under the name of "All Seasons." The following year W. Atlee Burpee procured seeds from Mr. Vandergaw, without the slightest idea that it was the parent of the "All Seasons," and grew a stock of seed, which he sent out as a "novelty" under the name of "The Vandergaw."

A Mr. Strang, whose farm is particularly noted for the growing of early crops, has developed a strain of the Flat Dutch cabbage that excels for earliness, uniformity in size, freedom from superfluous leaves, tenderness, and, in fact, all the good qualities sought in a variety together with a sureness of heading that has made this one of the most popular varieties under cultivation. Whether this success is due to soil and location, or to the infinitely greater care and attention he paid to the growing of his crops than the average farmer gives we are not prepared to say.

This variety was introduced to the trade under the name of "All Head," which is truly significant. So valuable is this strain for commercial purposes that a large number of dealers have sent it out as a specialty bearing their name with a special prefix.

Other strains have been given names of local significance. It is a fact known to all interested in vegetable forms that where any class can be well grown, that is, where it shows a tendency to improve with good cultivation, that these selections can, and should be, made for that locality. There the plant will adapt itself to the conditions of soil and climate, and develop types superior to any that can be produced elsewhere. This principle holds good with all seeds; and the seedsman, without regard to the name given to his various types or varieties, always secures his stocks from localities where the plants can be grown to the greatest perfection.

We have written this much to give some insight into nomenclature and to show the origin of the vast number of variety names given to strains, or so-called varieties, not at all dissimilar.

WAKEFIELD AND WINNINGSTADT GROUP.

This group includes cabbages with pointed heads, of which there are numerous varieties, but few of the same are in cultivation for market cabbages in this country, and to these only shall we give special mention, as they are the only ones the American gardener is interested in.

The Jersey Wakefield.—This variety was introduced from England about forty years ago, but of its history or original name we have no knowledge. From the date of its introduction it has been a popu-



Fig. 1.—Early Jersey Wakefield.

lar sort, and deservedly so, for in point of usefulness it has no superior. In our climate it has improved in size and earliness, the consequence of being grown on different soils, as previously mentioned.

We do not know of any cabbage that is so peculiar in its likes and dislikes as the Wakefield,

neither one so liable to variation when the conditions of soil are uncongenial. We say conditions of soil, because we cannot attribute the marked changes we have noticed in the type, when grown in close proximity, to any other cause. We have found within a radius of one-fourth of a mile from a given point on Long Island, that from the same seed, and under the same cultivation, there is a marked difference in the



Fig. 2—Charleston Wakefield.

type, in almost every respect. Here plants are uniform as to size as well as in color and substance of leaf. The plants seem to grow to perfection from choice, while those grown but a mile distant are irregular, the leaves are crumpled and twisted, and the heads coarse and unshapely. We are now

speaking of the regular type, but have seen as marked a difference in an extra early type which makes a smaller head. This in a given locality makes a more uniform head and more regularly pointed, than when grown but a short distance in other directions.

There seems something inherent in this kind of cabbage to cause it to sport, but mainly in the shape of head, some heads being nearly as round as the Early York, while the type should be pointed. Most of the strains grown show a marked tendency toward round or oblong heads. The distinctive strains of the Wakefield cabbage are: The "Early Jersey Wakefield" (Fig. 1), and the "Late or Charleston Wakefield" (Fig. 2).

The character of these is now pretty well defined, and, as they are grown on Long Island there is about ten days' difference, in their period of growth. The size of the Charleston Wakefield is proportionate to the time it has to grow, as six pounds of any vegetable requires a longer time to grow than four pounds. In this group may be placed the "Long Island Beauty." This is a selection from the round-headed Wakefield and grown on the heaviest soil of Long Island. It has all the characteristics of the Charleston Wakefield, other than in the size and shape of head, but it is larger and quite as early. The heads, in shape, are midway between round and conical. We class this with the pointed-headed cabbage, because of its parentage. High cultivation is undoubtedly the cause of its large and round heads, as when given poor cultivation, the tendency is toward pointed heads.

Among the other pointed sorts, the following

are recommended for garden culture, but are not profitable for the market gardener:

Early Etampes.—Next to Wakefield, one of the best early sorts.

Extra Early Express.—Early, but small.

Very Early Paris Market.—A type midway between the large and small ox heart varieties.

Early Ox Heart.—Conical heads, but little used.

Very Early Winningstadt.—For the private garden this is one of the best in cultivation, and, if



Fig. 3—Very Early Winningstadt.

planted for a succession, none other would be required; in point of tenderness or flavor it has no superior. But it is of no use as a market cabbage. Its good qualities for the table make it unfit for the market. (Fig. 3.)

FLAT DUTCH OR DRUMHEAD GROUP.

In all catalogues these are made distinct classes, and of each class there are numerous varieties; the claim of superiority being based in the care used in selection, and of the seeds being grown under the most favorable conditions for the development of the type desired.

The name Flat Dutch was given the type to designate it from the round or pointed heads as grown in Holland nearly a century since. About 1800 we find Drumhead cabbage noticed, a name applied because of the great size. A few years later Flat Dutch Drumhead was listed and soon thereafter the names became separated, and "early" and "late" applied to each.

There is much confusion in nomenclature in the various classes of the Flat Dutch cabbages, because of the popular or local names. In this class there are three distinct types as regards earliness, and each of these has about as many local or trade names as there are dealers. There are, strictly speaking, early, late and intermediate varieties. By planting the three classes a difference in maturity of about three weeks between the earliest and latest sorts will be noticed.

To show that the difference in varieties is more imaginary than real, we would say that in our fields and trial grounds, when parties have sent us their stocks to grow, we have never had but one man that was able to distinguish his own.

In the *early* class, Henderson's Early Summer, Early Flat Dutch, Early Drumhead, Newark Early Flat Dutch, Early Deep Head and Faultless, are best

represented by All Head, originally known as Strangs. (Fig. 4.)

Of the *intermediate* sorts, All Seasons, Vandergaw, Gregory, Succession, Surehead, Bridgeport Drumhead, Louisville Drumhead, Solid South, Stone Mason, Stein's Flat Dutch, Fottler's Brunswick, Short-stem Drumhead, Premium Flat Dutch, Excelsior Flat Dutch and Safe Crop, are best represented by Stein's Flat Dutch, which is shorter-stemmed and a trifle flatter than the All Head.



Fig. 4—All Head.

Of the *late* varieties, Large Late Flat Dutch, Large Late Drumhead, Marblehead Mammoth, World Beater, Autumn King, Hundred Weight and Colossal, are best represented by Market Gardener's Private Stock Flat Dutch (synonym — Acme, Houseman). (Fig. 5.)

It must be understood that the enormous heads

reported to have been grown, and exhibited, cannot always be produced from the same kind of seed. Because there are occasional instances of such monstrous heads, it does not prove them to be the result of the putting out the plants of a given variety. They are due rather to natural conditions favorable for growth, and to the fact that every possible care and

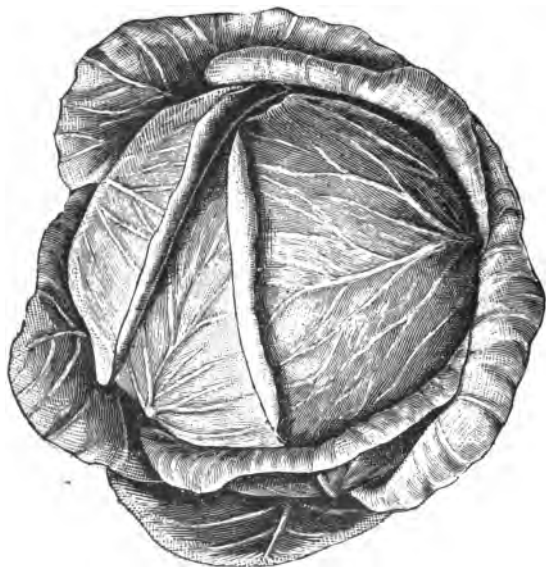


Fig. 5—Market Gardener's Private Stock.

attention has been paid to cultivation. Enormous growths cannot be expected in other than deep, strong soil, rich in every element essential to this particular growth.

The amateur gardener is often disappointed, and feels himself injured when he buys seeds and plants for an enormous growth and gets below the

ordinary one. He should not be, for there is not one-half of one per cent. of the soil planted to cabbage that has in it the possibilities of such unusual development. Besides this fact, there is another important consideration, viz.: The relative value of such a production. Any one who has tried the experiment knows full well that it costs double to produce one hundred or even fifty pounds of cabbage in one head than it does to produce the same number of pounds in ten heads. The market gardener fully understands this, and in his selection of varieties chooses such as make good solid heads in the shortest time and at the least cost.

We choose to let this statement come in with the list, and brief description of varieties, so as to counteract, as far as possible, the mistaken idea of selecting for size, rather than for productiveness and quality. The grower,—whether for his own use or for market—should select such varieties as will give the best results in the place he has for them.

THE SAVOY GROUP.

This forms a distinct class, but thus far an unimportant one, commercially, notwithstanding its being by far the most tender and richest flavored variety of cabbage, when grown under favorable conditions. The Savoy must not be grown on poor soil, neither must good cultivation be neglected. It is a gross feeder, and seems to delight, more than any other sort, in a congenial soil. In such it makes a large head, of good size and solidity, and its rich marrow-like flavor surpasses that of any other of the Brassica vegetables.

A well-grown Savoy in the garden is a picture, its rich deep green color, finely netted and regularly imbricated leaves make it the rose of the vegetable garden. Notwithstanding its delicate structure, and tenderness when cooked, it rivals the kale in hardiness, and will endure, in field or garden, fifteen or even more degrees of frost, without apparent injury. With but a slight covering of straw, or leaves, which are more for a protection against the sun than the



Fig. 6—American Drumhead Savoy.

frost, it can be wintered in the garden, in the latitude of New York, without injury. Like the Brussels sprouts and kale, the Savoy is greatly benefited by a few degrees of frost.

The Savoy cannot be well grown as early or intermediate sorts in this latitude; they do not thrive in the hot weather of July and August, but make their best growth from the middle of September until the middle of November. The Early Ulm Savoy comes in moderately early, but it, nor any other of

its class, does not compare at all favorably with the following American-grown sorts:

Marvin's Savoy, Drumhead Savoy, Perfection Savoy, Improved American Savoy. All these are nearly alike, and all Long Island stocks. (Fig. 6.)

All the varieties grown in this country have a tendency to grow larger and later than the imported sorts. Many dealers have prefixed their own names



Fig. 7—Mammoth Rock Red.

to the various Savoy's above named, without improving or detracting from the quality of the variety. A dealer's name as a prefix to any variety simply shows his confidence in what he has for sale.

THE RED CABBAGE GROUP.

Its color is the distinguishing feature of this group, although by many it is also highly esteemed

for its richness of flavor when cooked with vinegar. It is also much used for pickling, its color making it a pleasing dish for the eye as well as its quality for the palate.

This class has undergone the same changes in size and form—by selection and adaptation—that are noticeable in all the other classes under cultivation in this country. It has been increased to fully three times its original size, and this without any loss of color.

The Mammoth Rock Red is the variety chiefly used. This produces heads weighing from ten to fifteen pounds, very solid, and of the darkest color to the center of the head. There are two strains of this, one has very dark, the other quite light outside leaves, in some instances nearly as light as some of the white cabbages, while the heads are of the darkest purplish red color. (Fig. 7.)

The Mammoth Rock Red should be treated the same in all respects as the late varieties of white cabbage, but higher cultivation is necessary to produce large and solid heads.

The Red Dutch variety is used to some extent in private gardens where but a single head is all that would be required. The plants of this variety are almost sure to head under any circumstances, although the heads may be small, they will be perfectly solid, and of the proper color. It can be grown to advantage, if an early head is desirable, as it will make its growth much sooner than the Mammoth Rock Red. It is one of the hardiest of all cabbages, and had its origin near Mineola, Long Island, the result of careful selection.

THE DANISH BALL HEAD GROUP.

Danish Ball Head, Hollander, Danish Emperor and German Export form this class, which is rapidly growing in favor, because of their excellent shipping qualities. The heads are of medium size, and for solidity they are not equaled by any other sort. We consider the three but different names for the same variety. Having grown them side by side for a number of years, we have not been able to see the slightest difference in shape, size or habit of growth.

These have, however, a peculiarity strictly their own, that is, in their habit of growth, which is by no means fixed. A casual look at a field would give a very faint and poor impression of this cabbage, as there is no such a thing as fixed habit with it, other than that it always produces a head, and whether large or small, it will always have that cannon-ball appearance that is characteristic of this class. In distinction from other sorts the heads of this are solid from the start. When not larger than an apple they are as hard as a full-grown head. Some of the plants will be tall, others dwarf, whichever it may be, the plant is sure to make a head of some size, and that head will be solid.

That this habit may and will be changed by careful selection, we have not the slightest doubt. This work is now well under way, and we await the result with no little interest. The most important consideration in its adaptation to our soil and climate is whether it will hold its solidity of head, which makes it so valuable for shipping purposes, besides making a desirable sort for late keeping. The lesson taught by the development of the red cabbage, which

has changed its habit to a remarkable degree, without a change in its distinctive character, leads us to hope for similar results with this group.

Our trial ground experiments have taught us a valuable lesson, which is, that it is folly to look for good results with this class of cabbage with ordinary cultivation. The best results are only obtainable when it is grown on sod ground, which should be liberally treated with stable manure before plowing, after which tilth should be as thorough as the nature of the soil will permit. When the plants are ready to set, apply one hundred pounds nitrate of soda per acre in the rows and another one hundred pounds just as the heads begin to form; apply the last as near the plants as possible and cover with the cultivator. This will give a crop, in a good season, of from twenty-five to thirty tons per acre.

To this class might be added Gregory's Hard Heading Cabbage (*syn.* Luxemburg) which shows plainly its parentage, in its specific character. This strain has an enviable reputation on Long Island, as a good keeper. Many farmers use it exclusively for burying, and they affirm that it keeps perfectly in the trenches until April, with the loss of but few outside leaves, and that the heads come from the trenches perfectly white, which is characteristic of the class from which it originated.

THE ALPHA.

This does not belong to any well-defined class, but has so many characteristics peculiarly its own as to constitute it an individual type, or class by itself. In earliness it is a peer of the Early Jersey Wake-

field. If there is any difference between them on this score, the Alpha takes the lead, coming in a few days earlier. In leaf, in point of color and substance it is similar to the Wakefield. In solidity of head it compares favorably with the Danish Ball Head; it is also sure to head, and, whether large or small, the heads are intensely hard, even when not more than three inches in diameter. The heads have but few outer leaves, so that the plants can be set even closer than the Wakefield; they do well one foot apart in the row.

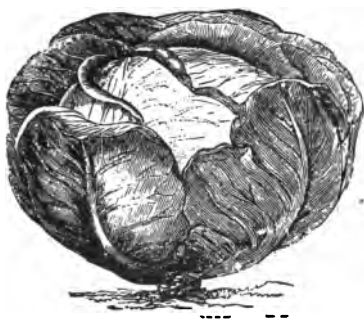


Fig. 8—The Alpha.

In habit of growth its individuality is shown to the best advantage. In our trial grounds we had heads eight inches in diameter, and not more than seven inches above the ground, while in the field, where they were planted still closer, they were quite as dwarf, and the size of the heads is from five to eight inches in diameter. (Fig. 8.)

For *cold slaw* it is one of the best we have ever known, being of fine texture, tender, and of good flavor, while for boiling it is all that can be desired.

Although it has not yet been offered to the trade, we speak for its great popularity in the near future..

CABBAGE FOR SAUERKRAUT.

As a rule, one would suppose that the best cabbage for boiling would be the best for sauerkraut, but those who make and eat it say not. As the fermentation destroys the fine flavor of the Savoy, this is not used because of its tenderness. The manufacturers prefer a solid head, of good size, and one of medium earliness. One concern of Long Island has for the past two years used the All Head, and cannot be induced to try any other. They usually furnish the grower with the seeds, and for a succession they make several plantings at intervals of about three weeks, commencing with plants grown from seeds sown in the open, as soon as the soil is in condition to be worked.

CAULIFLOWER.

The Cauliflower as a market crop is rapidly increasing in importance. When the industry was started on Long Island, N. Y., it was supposed cauliflower could not be grown elsewhere, because the climatic conditions and character of soil were in harmony with its requirements here, and not elsewhere. The large returns for the crop soon made its growing very general on the east end of the island, and the production was enormous, as may be seen by the fact that one commission merchant in New York shipped daily to Philadelphia three hundred barrels, and other merchants forwarded as much, not only to Philadelphia, but to other cities. This stimulated the market gardeners in other sections of the country to efforts at production on their farms, with the most favorable results following.

Soon it became apparent that cauliflower could be profitably grown on the Atlantic coast from Maine to Florida. But the industry soon spread farther, until the Pacific coast became an active competitor with the east. Fresh cauliflower is now coming in by the carload daily from California all winter, and is selling at two dollars and a half per crate, which is a satisfactory price to the shipper and keeps eastern markets supplied with this delicious vegetable every day in the year.

CULTIVATION.

The culture of cauliflower does not essentially differ in general from that of cabbage. The soil is

prepared in the same manner, the seed is sown, and the plants are set in the same way. But the culture usually given the cabbage is not sufficient for the cauliflower, as cabbage will suffer, with impunity, an amount of abuse in cultivation that would be fatal to cauliflower, which insists on thorough tillage and liberal treatment as regards manure, and will not tolerate neglect in any respect. Nevertheless if the same amount of care was given to cabbage that the best growers of cauliflower give to the cultivation of that crop it would be doubly profitable.

On Long Island, which is a congenial home for the cauliflower, the seed is sown at intervals from the first of May to the middle of June. The farmers usually make three sowings, intended for an early, an intermediate and a late crop. In some seasons the best results are from seed sown as late as the first of July.

There is no crop about which there is so much uncertainty as that of the cauliflower; no calculation can be made as to the time of sowing the seed, or in setting the plants, that will insure success. All, or at least much, depends upon that fickle goddess, *Luck*, whose favors are strangely dispensed. The early, the intermediate and the late plantings are, in turn, profitable. Not unfrequently the slow man—he who is always behind—will reap the greater reward. Hence the necessity of a series of plantings, one of which will almost invariably succeed. It is safe to say that when a good crop is secured, it is a very profitable one.

The character of the soil has generally been supposed to be of the greatest importance in the cultivation of this crop; a heavy loam with a gravelly

subsoil being considered the most favorable. But recent developments have shown most conclusively that the condition of the soil is a more important matter, and that climatic influences have more to do with success or failure than either. We have often seen as good crops on light sandy soil as on the best loam. Whatever the nature of the soil may be, new ground, or rather sod ground, can always be more surely depended upon for a crop, than to let it follow some other.

Cauliflower is more sensitive to checks in its various stages of growth than cabbage. In the seed bed, a strong sturdy growth should be encouraged, rather than a rapid one. With this, as with many other crops, it is a mistake to make the seed bed too rich; in such the plants make too rapid growth, and are much more liable to a check when transplanted. It is better, by far, to start the plants in a poor soil, and transfer them to a richer one, as they will be then in a better condition to assimilate plant food.

The most important part of cauliflower cultivation is the growing of the plants. The lack of system and knowledge of the plant's necessities in this respect have been the causes of more failure of crops than all others combined. Good plants can never be obtained by leaving them where the seed is sown until they are supposed to be ready for transplanting. As soon as the second leaves are half an inch long, the plants should be pricked out into finely-prepared soil and set half an inch apart in the rows, one inch apart. Again, when the third pair of leaves is one inch long, they should be again pricked out, this time—for convenience of transplanting in the field—into shallow boxes, say, two inches deep. Set the

plants an inch apart each way, water thoroughly as soon as each box is filled, and let them grow on until the proper time for setting in the field. This will secure almost absolute success. The plants will have formed a solid mass of roots, and, with but little care in transplanting the plants will not receive the slightest check in growth, which is so essential to success.

CAULIFLOWER AS AN EARLY SUMMER CROP.

It has generally been supposed that, in our climate, cauliflower cannot be made a summer crop, than which there can be no greater mistake. It can be, and is made a most profitable summer crop, every year by a farmer near Jamaica, L. I. This person grows sixty acres annually, and from plants produced in the manner described on Page 30. His plants are grown under glass and are ready for the field as soon in the spring as the soil can be brought in proper condition to receive them. When his plants are set a handful of shell lime is scattered closely around each. This he considers a guarantee against club-root and stem-rot, from the fact that he is never troubled with either.

The crop from his sixty acres is all harvested in July in time for some other crop which is sure to follow for autumn market. But for the ravages of the cabbage worm he would have an equal acreage for cutting in August and September.

CAULIFLOWER GROWN UNDER GLASS.

This, when thoroughly understood, is an interesting and profitable branch of market gardening. The person referred to above is also a most success-

ful grower of cauliflower under glass, and has fully half an acre growing at all times during winter. Previously to the shipments from California, during the winter season, which has somewhat lowered the price, it was a very profitable crop, as it could be produced in



Fig. 9—Early Erfurt Cauliflower.

eight weeks from the sowing of the seed, and sold readily at fifty cents per head. The plants are all grown as before stated, and set when about four inches in high. Between them, and in alternate rows, lettuce is planted. These two vegetables grow in harmony together, as they require the same

temperature, and are ready for cutting by the time the cauliflower requires the room they occupy.

The soil on the benches is about six inches in depth. A lively loam made rich with well-rotted manure is best suited, and, with a temperature of sixty degrees by day and forty-five degrees by night, the growth is rapid and healthful. An application of nitrate of soda in solution, at the rate of two hundred pounds per acre, when the plants are first set, is particularly advantageous.

VARIETIES.

There is but one type of cauliflower adapted to the Atlantic coast, namely the Erfurt, of which there are both early and late varieties. (Fig. 9.) These are sent out under a score of names, but they are Erfurt, for all that. What is a strange peculiarity with this vegetable is, that the seed best adapted to our country does not come from the place from whence it derives its name. So many are interested in this crop, and have so little knowledge of the seed, we reproduce an article we furnished the *Florists' Exchange*, and which will show very plainly why good cauliflower seed must of necessity be sold at a high price.

CAULIFLOWER SEED.

There is no seed coming into our country that is in such common use, and about which there is so little known, as that of the cauliflower. Where and how grown is a mystery that but few of the seedsmen who handle it care to inquire into. The most common variety, the Early Dwarf Erfurt, which has

about as many trade names as there are dealers that handle it, is generally supposed to be grown in Erfurt, Germany, whence it derives its name. That cauliflower is largely grown there does not admit of a question, and that it there reaches the highest state of perfection is a fact also well known. At the same time, but little of the seed which bears that name is grown there.

Let any foreign seedsman visit that city when the cauliflower is in perfection, and he will be shown the same field by nearly every seedsman in the place, each claiming it as his own, and he will be given to understand that his stock of seeds comes wholly from this field. The same is true in our country. Long Island has the reputation of being a congenial home of the cauliflower, and much seed is sold in other parts of the country as Long Island grown seed, when in fact, it would be almost an impossibility to grow a seed here, because our climate is too dry and hot to produce it.

"Whence does it come?" is a question we hear from every side, and the one we will answer. But first we will say there is a peculiarity about cauliflower seed that is not common to any other class of vegetables. That is, the same seed, when grown under different conditions, produces entirely different results. For instance, seed grown in Holland will succeed admirably in England, but will be utterly worthless in this country; and, too, the same seed grown here may give the best satisfaction in a wet season, and be utterly worthless in a dry season, and the reverse.

The best seed we get, in fact, we may say all the *good seed* we get, comes from Copenhagen, Den-

mark, and it matters not whether it comes through French, German, English or American dealers, it is of Danish growth. It is indeed strange that the finest quality of Erfurt cauliflower, with its various synonyms, is only grown in the little kingdom of Denmark. But, what is still more strange, the best seed is only produced in circumscribed localities in that little country. The country being so small in extent, and of the same, or nearly the same, geological formation, and with but little variation of climate, as there must be when we consider that the whole kingdom is not half as great in extent as the state of New York, and that the highest elevation is but four hundred feet, one would naturally suppose there would be but little difference in its vegetable production; such, however, is not the case. On the peninsula of Jutland, which constitutes the larger area of Denmark, all attempts to grow cauliflower have proved utter failures.

All the best cauliflower seed furnished to the United States and other parts of the world is grown in a few spots on the island of Zealand (Seeland), where the climatic conditions are most favorable for the perfect development of the head, as well as for the production of the seed. Under the most favorable circumstances the seed crop is a very difficult one to obtain, it being secured at great cost, and with great risk, as will be seen by the following description of the methods employed in its cultivation:

The seed is sown in cold frames early in September, and, to carry the plants on through the winter, and until time to transplant into the field the coming spring, requires an amount of care and labor that none but a patient, slow-going and industrious

people would submit to. There is a secret, too, about keeping the plants in a healthy condition, that can only be learned by years of practical experience; it cannot be taught. During some winters, when there are no great extremes of temperature, the difficulties attending the keeping of the plants and of growing them on through the winter are not serious. But when severe and long-continued frosts, accompanied by heavy snowstorms, which make it impossible to freely air the frames; and again, when the weather is so mild as to excite an unhealthy growth at a period when the plants should be kept as nearly dormant as possible, then difficulties multiply rapidly, and it is a fight for life. Often the entire crop of plants rots away during these trying seasons, even with the most careful attention. Taking it for granted the plants have gone through the winter safely, in early spring they must be transplanted into hotbeds to be "started" into active growth before setting out in the open fields, and this is an uncertain work; at least, the proper time is difficult to determine, as the seasons are very variable. It is important to have the plants ready for the field at the earliest moment, consistent with safety. But if started too early and the "winter lingers in the lap of spring," the grower is again in a quandary. If the plants are started too early, they may be either frost-bitten or rotten before planting time comes.

In the most favored seasons, the plants are set in very rich and mellow soil from the 10th to the 20th of April, and commence active growth, stimulated by the warm, moist atmosphere wafted over the land from the surrounding sea. And when the grower's expectations are the highest, his plants

making rapid and vigorous growth, and the heads begin to form, a drouth sets in which blights his hopes, because, if he has no means of irrigation, his cauliflower field will soon present a sorry sight of stunted, irregular, small or leafy heads, which contrast sadly with those grown when the Danish climate is true to its nature. Then the fields are a mass of almost dazzling beauty; the heads are all perfect in form, large, smooth and pure white. Again, there is a moment of suspense; the heads may be too solid, so that the seed stalks cannot break through, which makes it necessary to cut out a small piece from the center of the head, and in doing this there is danger of cutting the seed stalk, which would ruin that head for all purposes.

This danger past, the field is a mass of golden yellow flowers, warming up the grower's anticipations of a successful crop, another trouble looms up. An insect enemy appears, almost too small to be seen by the casual observer, and eats away the pistil, which prevents fertilization, sometimes in part, at others wholly. The work of this invidious destroyer is rapid, and against its attacks there does not appear to be any protection.

But suppose all dangers safely past until September arrives, a year from the sowing of the seed. The pods are fully developed, and the seed shows signs of ripening, when the greatest danger of all awaits the grower. The full development and ripening of the seed, when the fall weather is very cool, cloudy and moist, may be entirely prevented or protracted for many weeks. To cut the seed stalks too early is dangerous; it may cause a greater or less proportion of the seed that appeared well developed

to shrink or turn light; and to leave it too long in the field is to invite night frosts to kill the germinating power, or at least weaken it. Frosts frequently occur in September, but to have the seed perfectly developed and matured it should remain in the field uncut until about October 10.

To prevent injury from this cause it sometimes becomes necessary to start lines of fire, from turf and gas tar, or anything not too expensive or difficult to obtain, that will cause a vast amount of smoke; these fires are started on the windward side of the field, and, if the work is well done, will save the crop.

This completes the growing of the crop. When the stalks are cut they are hung up in open sheds for a few weeks, so that the seeds may draw as much nutriment as possible from the stalks, get well colored and dry enough for threshing out. In our rare atmosphere seeds of similar character do not require so much attention, but will ripen or "make" thoroughly in the field after having been cut two or three days.

Thus it can be readily seen that cauliflower seed cannot be produced in Denmark even, excepting at great cost, and no one grower ever produces a large quantity. The farms there are all small, the production entailing the hardest labor, and what we would consider a small amount a Danish farmer would regard as a heavy crop. Some of the largest dealers have their local agents there look out most carefully for the best stocks.

We are often asked if the growing of cauliflower seed cannot be made a profitable industry in this country; to which we reply, No, most emphatically, on the Atlantic coast. On the northern Pacific

coast some very good seed has been grown. Last year we tested two samples; one Early Snowball, the other, Dwarf Erfurt. The first named sorts made very leafy heads, the other was as good as could be desired. From our experience with these sorts, another trial might be the exact reverse. Thus far, as a market gardener's crop, we should not dare to rely upon the Pacific coast seed, but we predict, with confidence, that the time will come when as good seed will be produced in our Pacific states as we can get from Denmark. Experience is a great educator, and when applied carefully, and with a determination to succeed, success will come.

It must not for a moment be supposed that all the seed that comes from Denmark is grown there. They have merchants there with as keen an eye to profit as any in the world, and from Danish stock cauliflower seed is grown from Norway to Algiers. In appearance there is but little difference, but there is a test that is more safe, viz., price. When that is low, it is safe to conclude that the seed was not grown in Denmark, for Danish seed always commands a high price. But there is a more crucial test. Give one of those who offer seed at a low price an order conditioned upon its good quality, payment to be made after testing it. No matter how high may be the rating of the one giving the order, and even if 10 per cent. were added to the price for interest, the order would not be recognized.

BROCCOLI.

The Broccoli is a hardy variety of cauliflower, much grown in England and on the continent, because it is sufficiently hardy to withstand the rigors of their winters, which the better varieties of cauliflower will not do. It is there very much grown



Fig. 10—Early White Broccoli.

and highly esteemed. In this country it has not been grown extensively, but could be to advantage in many sections on the southern coast, but for its destruction by the cabbage worm. It should be treated in all respects like the cauliflower. (Fig. 10.)

COLLARDS.

The Georgia Collard, which is grown largely at the south for "greens," is a variety of cabbage that does not form heads. It is the same that in France is called cow cabbage, because it is there largely grown for its leaves, that are stripped from the stem and fed out during winter. It grows there to the height of five to six feet. It is also largely grown on the Isle of Wight for the same purpose. And the dried stems are there considerably used for making light walking sticks.

In England, the term collard is applied to young unheaded cabbages, which are pulled up by the roots and tied in bunches for the market. This is what one gets served with there at the hotels when cabbage is ordered. "White cabbage," as they term cabbage that has headed, and as we use it, is not considered fit for the table, and is only used as feed for stock.

In our southern states, under extreme climatic conditions, it has assumed a type quite distinct from that grown in moist, cool climates. For "greens" it is a valuable plant, being of easy culture and very productive. As in Europe, when the leaves are taken from the stem others form on the top and the plant increases in size. The seed should be sown as for cabbage, from June until August, for a succession. Transplant in rows thirty inches apart, and the plants one foot apart in the rows.

Prof. W. F. Massey of the North Carolina experiment station, highly recommends its use at the south, and speaks of it as follows in the *American Agriculturist*:

To most northern readers the collard is an unknown vegetable, lightly passed over in seedsmen's catalogues as a "non-heading variety of cabbage grown in the south," and but few of them know that when properly blanched even the loose, unheaded collard is a vastly sweeter and more delicate vegetable than the northern cabbage. Therefore, if it can be induced to head and bleach with certainty we will have no cause to regret most of the coarse, large cabbages. There are several varieties grown, from the dark purple-leaved, green-leaved, to a variety with a loose, open head, but self-blanching. I believe that we have at the station the seed of the cream of all the collards from Texas, Louisiana, Mississippi, Georgia, and North Carolina, and may count on good results. In the meantime I am by no means satisfied that the best of the northern cabbages cannot be grown here.

The general practice with growers here is to sow cabbage seed in the spring, just as truck farmers at the north do, and transplant in July, and then when the cabbages succumb to the long heat and drouth, and the swarming insects, conclusion is reached that we cannot grow cabbages for winter use in this climate. Last summer I sowed seed of Late Flat Dutch cabbage the middle of August. The plants were set out in September. But the autumn was uncommonly dry, and I feared at one time the experiment would be a total failure. Yet in spite of all, and in soil of only moderate fertility, very fair



Fig. 11—Branching Collard.

heads of cabbage were made by Christmas. Had the season been as rainy as usual the crop would have been very good. Now here, it seems to me, is a good suggestion to southern planters. Sow the cabbage seed not earlier than the last of July. Set the plants in ground naturally moist, manure very heavily, and work rapidly, and good cabbage can be grown in most seasons. Then, after succeeding in getting good heads, save the best for seed, and develop a strain suited to your wants.

The cabbage, a native of a cool, moist climate, must necessarily degenerate in our hot summers, but in most places in the south all kinds of cabbage thrive from October to May. We grow early cabbage for the north in great quantities, and by bringing our winter cabbages into the earlier part of the cool season, I can see no reason why we may not grow them as well as the spring crop. So, while holding the collard to be "a survival of the fittest" in this climate, and proper stock to work on, we will not altogether abandon the hope of profiting by the skillful selections of generations of seedsmen as represented in the best sorts of heading cabbages.

Fig. 11 is an exact representation, engraved after a photograph, of a specimen grown in Florida, the stem of which was four feet high, and the height of the entire plant eight feet.

BRUSSELS SPROUTS.

The growing of Brussels Sprouts is rapidly increasing, and that because the industry is more profitable than many others. Since the farmers on Long Island began its cultivation the acreage planted has about doubled annually without any falling off in the price of the product. This is due to the fact of the vegetable becoming better known. It is now justly regarded a delicacy, one of the most delicious of the Brassica genus. As with other articles, reputation increases the demand, and the greater the demand the better the price.

CULTIVATION.

The cultivation of Brussels sprouts does not differ in any respect from that of the cabbage and cauliflower. It will thrive under ordinary cultivation. It will amply repay all the care and attention, as regards cultivation, that can be given it. For an early crop, the seed should be sown the first week in June, and the plants grown on and transplanted in the same manner as recommended for cauliflower. As the plants are more compact in their habit of growth than cabbage they may be set two feet apart in rows three feet apart. This will give 7,260 plants to the acre, which, with good cultivation, will give 10,000 quarts to the acre. But few growers, however, get such results, which is not the

fault of the plant, as its capabilities are fully as great as stated.

As a rule, the young heads will be ready for market by the middle of October, but they should not be picked until after the first hard frost, which makes them more delicate and tender. Picking may commence at any time after the little heads are an inch in diameter, if they are hard and solid, stripping the larger ones first, which will afford the others a chance to grow, and this they will do at all times when the circulation of sap is not checked by severe cold and the picking is kept up the entire winter. Upon the approach of winter, in latitudes where there are heavy falls of snow, the plants can be cut close to the ground and stored in a warm shed or cellar and the little heads taken off at leisure.

For a late crop a sowing may be made the last week in June, and these plants will remain out during the winter, and the crop gathered in March. The plants will endure twenty degrees of frost without injury, and will grow every day during winter when the temperature is not much below the freezing point.

The crop is marketed in the following manner: The little heads are broken off from the stem and packed in quart boxes and these are packed in crates in precisely the same manner as strawberries. Care must be taken in packing to remove the loose outer leaves from the heads so that they will appear fresh when they reach the market. As the season advances there will be more of these to be taken off. At the same time the price usually advances late in the season, so that in case the heads are half wasted in picking over, the profit will be just the same.

This is comparatively a new industry in this

country, but the sales are annually increasing, and the price has at no time been so low that they have not been a good paying crop. The price obtained depends largely upon quality, or their appearance when they reach the market. Those who take special care in packing—putting the little heads in



Fig. 12—Long Island Improved Brussels Sprouts.

firmly so they will not shake in transit, and having the top layer in regular rows, top side up—get nearly double as much per quart as do those who pack in a careless manner.

An important consideration in the growing of this crop is, that it furnishes work for the winter,

when the farmer and market gardener has but little to do. In many instances the hired man is now employed the whole year, as his services are as valuable in winter in picking and preparing the sprouts for the market as they are in the summer in growing them. The farmer who has employment every day in the year materially increases his income.

VARIETY.

There is but one variety in general use with us, and that is the half-dwarf (Fig. 12). The best seed is now grown on Long Island, as the growers are paying special attention to the saving of the seed. The same improvement that has been made in the development of the cabbage is equally marked in the Brussels sprouts. By careful selection and through climatic influences, the variety has improved both in quality and productiveness. From the improved type two quarts of the little heads fit for market have been taken from a single plant. But a quart from a plant would be a good crop, and a paying one, as a quart is worth in the market at least twice as much as a head of cabbage—frequently from three to four times as much.

KALE OR BORECOLE.

The nomenclature of this vegetable is decidedly mixed; there are many varieties and sub-varieties, and each has its local or popular names. Of the Kale there are three distinct types, the Scotch, Siberian, and brown or purple; of these there are tall,

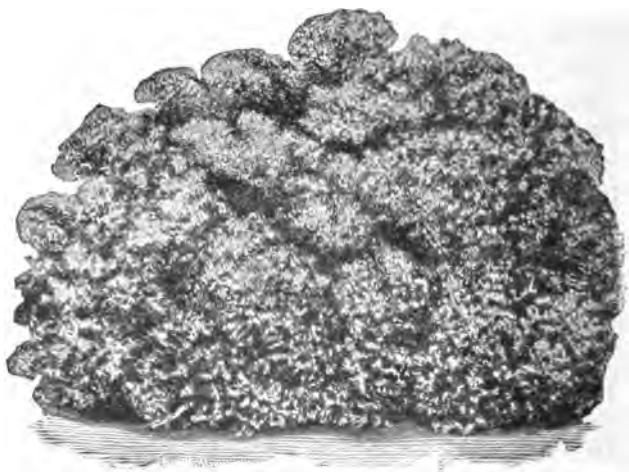


Fig. 13—Dwarf Scotch Kale.

dwarf and intermediate sorts. In some localities they are classed sprouts, in others German greens, but now, in our markets it is generally known as kale without regard to variety or type. The dwarf curled or finely-fringed varieties are now the most

generally grown, and of these there are two distinct sorts:

The Dwarf Scotch (Fig. 13), which is sold in different countries under a score of names, is our most desirable variety, because of its hardiness as well as for its excellent quality, to which may be added great beauty. From their dwarf habit the plants are liable to be covered with snow during the winter, but even without this protection, it is rarely, if ever, injured by frost, and can be cut at almost any time during winter. The leaves are of a light green color, and as finely fringed at the edges as the finest curled parsley.

The Siberian kale has very nearly the same habit, but is a stronger grower, with much darker leaves, but equally as finely fringed. It is by no means as hardy as the Scotch kale, and in this climate the outer leaves are frequently destroyed by frost, so as to be unfit for use, while the Scotch will not be at all injured. The last winter, which has had short periods of unusually severe cold, has not injured the Scotch kale in the least, while the Siberian, though not killed, had to produce entire new leaves in spring, which it will not do if the plants are strong, as they will, upon the commencement of a new growth, throw up their flowering stems.

Both of these varieties are largely grown in Virginia for the northern markets. The seed is sown at any time during September, in rows sixteen inches apart, and the plants should be thinned out to six inches apart in the rows; they will then completely cover the ground. The only care required in cultivation is to keep the ground perfectly clean, but

not to cultivate deeply, surface working being all that will be required.

For a winter's crop, the Scotch kale should be sown by the first of July in the latitude of New York city, or at least a month earlier than in Virginia, and if sown on rather dry soils, where there is a good natural drainage, it can be profitably grown throughout the northern and western states. In some localities the Dwarf Scotch kale is known as German greens or sprouts.

We find the most carefully selected strains of both these varieties. Those whose leaves are the most fringed are the ones that will endure the most cold without injury. The seed of the Scotch is light colored, and can readily be distinguished from the Siberian, which is very black. If the market gardener is anxious to grow Scotch kale and has black seed sent him, he may know at once there is a mistake.

The brown or purple kale is the most hardy of all, and is a favorite with the German gardeners, but is not as much grown as formerly, because of its coarse habit, and that it is not considered as delicate a vegetable. But while there is a marked difference in the appearance of the growing plants, the taste does not find a marked difference in the varieties, as a vegetable.

KOHL-RABI.

Although strictly a cabbage, botanically, this vegetable stands midway between the cabbage and the turnip, and partakes of the character of both. The edible portion closely resembles a well-shaped globe turnip grown above ground. When young, and properly cooked, it is as tender and delicate as the cauliflower, and has as pleasing a flavor. When old, it is tough, stringy and unpalatable, excepting that portion next to the ground. No matter how tough and hard the upper portion may be, the lower part is always tender.

Kohl-rabi is fit to eat only when young, and not more than two inches in diameter; to that end a succession of plantings is necessary. Not, however, for a summer crop, unless grown in a moist soil and under a lattice shade, as it will not thrive during July and August in the open. In this respect it is quite similar to the turnip.

CULTIVATION.

The seed may be sown as soon as the soil is in good condition to work, either in drills, the same as the beet, and thinned out to two inches apart, or it may be sown in the same manner as the cabbage, and transplanted. The latter is the better way, as the small plants are more easily cared for in a seed bed

than in the field or garden. For an early crop the seed may be sown in a hotbed to good advantage. A good feature of this vegetable is that the seed may be sown at frequent intervals and the plants set whenever and wherever there is a vacant place in the garden. The soil should be made rich and fine, as rapid growth is the secret of success in getting the highest degree of excellence.

Kohl-rabi is a valuable crop for autumn, as the seed can be sown, and the plants set as late as the



Fig. 14—White Vienna Kohl-Rabi.

last week in September and perfect their growth; and be kept for winter use the same as root crops. But it will not do to plant in a soil already impoverished by the production of some previous crop. Wherever the plants are set, let the soil be as carefully prepared as for a spring crop. In France this vegetable was formerly much grown for feeding cattle, and highly esteemed on account of its not imparting a disagreeable flavor to the milk.

The varieties are the white and purple Vienna,

between which there is no perceptible difference excepting in color; the white, however, is the most pleasing in appearance, and the one most generally used. (Fig. 14.) The kohl-rabi is usually cooked and served with sauce in the same manner as early turnips. A good way of cooking is to boil until nearly tender, and then slice thinly and fry in butter. When cooked in this manner they are by far the most palatable of any of the Brassicas.

INJURIOUS INSECTS.

The insects which prey especially upon cabbage, cauliflower and related plants are obnoxious both to the producer and to the consumer. The former sees his growing plants destroyed by the ravages of worms and his chances for profiting by his labors daily grow less; while the consumer suffers revolting disappointment when the cabbage or cauliflower he has purchased shows, on preparation for the table, the canals and disgusting masses of excrement which mark the work of these pests on the mature vegetables. All are interested, then, in checking the ravages of these insects, but the successful solution of the problem has been somewhat difficult; for the character of the plants and the habits of the insects both interfere to prevent success from methods applicable against other insects.

THE CABBAGE WORM.

Best known of the cabbage pests, and the one which until within a few years has been the most harmful in the market garden sections, is the green cabbage worm, the larva of the familiar white butterfly, the imported or European species, *Pieris rapae*. These insects pass the winter as chrysalids or pupæ attached to the under sides of rails, sticks, weeds, or in any place where they are protected from excessive moisture. Early in May, or even in April,

if the air is warm for several days, the butterflies emerge from the chrysalid shell, soon pair and begin egg laying. The eggs, from 100 to 300 in number, are deposited singly upon the under sides and edges of leaves of old cabbage stumps, early cabbage, kale, wild radish, cress or related plants. The egg laying may last for three weeks, by which time the worms from those first laid have hatched, fed, grown to full size and are ready to pupate. The old butterflies live for some time after laying their eggs, so that

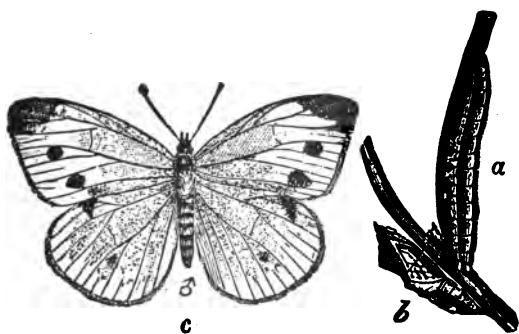


Fig. 15—Imported Cabbage Worm, Chrysalis and Female Butterfly.

before they have passed away those of the new brood have come out and are ready to start a new generation. This overlapping of broods makes it impossible to destroy all the pests at one application of an insecticide, no matter how successful; because any poison would be eaten only by the worms, leaving unharmed both eggs and mature insects. If all eggs and worms could be destroyed by hot water or insecticides which kill by contact, the butterflies would still remain, prepared to restock the plants with eggs.

This succession of broods continues throughout the summer, four, five or even more generations arising as the season is more or less prolonged. The larva of the imported cabbage worm is shown at *a* in Fig. 15, the chrysalis at *b*, and the female butterfly at *c*.

A few other species of the genus *Pieris* are quite destructive to cabbage in our southern states. Their life history and manner of feeding are practically the same as those of the imported cabbage worm, and the treatment is the same.

THE CABBAGE LOOPER.*

This insect, the scientific name of which is *Plusia brassicae*, has long been counted the most destructive of cabbage pests in the south, and for the past four years has been a worse enemy on Long Island than the cabbage worm. It is less known, however, and the injury it does is usually attributed to the cabbage worm; for the larvæ or worms are quite similar in color to the other species and the moths are less conspicuous in color, and fly principally on cloudy days and late in the afternoon, remaining concealed during the day under the leaves and in sheltered nooks and crannies. The worms are voracious and more general feeders, eating not only all plants of the cabbage family, but also lettuce, spinach, tomatoes, celery, carnations, chrysanthemums, smilax, heliotrope and many other forcing-house plants. They are especially destructive to forcing-house lettuce and a few moths in even a large house may soon cause irreparable injury, as a

*Condensed from a special bulletin of the New York Agricultural Experiment Station by Professor F. A. Serrine.

single worm may devour a newly transplanted plant in a night. The moth, worm and egg are shown in Fig. 16. The worms are marked, when partially grown, by distinct white lines along the sides; and, unlike the cabbage worms, they have legs only at the ends of their bodies, so that they travel by "looping" and not by crawling. In their life history they are quite similar to the cabbage worms, but appear earlier in the season and continue longer, with the same overlapping of broods which prevents easy

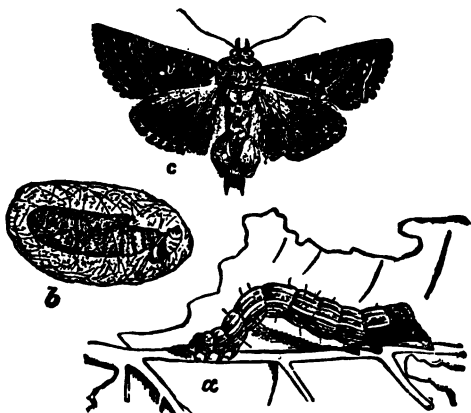


Fig. 16—Looper—*a*, Larva ; *b*, Chrysalis ; *c*, Moth.

destruction. In addition they have other peculiarities which increase the difficulty of combating them. They feed upon such a range of plants that poisoned trap-crops are of little benefit; and they work largely upon the under side of the leaves, where they may remain unnoticed until much damage has been done, and where only very thorough application of remedies will affect them. They are also active in movements, and discriminating in taste, so that they

quickly desert feeding places which show traces of poison or other foreign substances.

Requisites for Successful Treatment.—Plants of the cabbage character are specially difficult to treat with insecticides because of the crowding together of their leaves and the smoothness of the surfaces. These features of cabbage make it difficult to reach all portions of the plants and to make the insecticide adhere when applied. Any dry powder will adhere only in occasional spots upon the leaves, will generally collect along veins and midrib, which are not usually eaten by the worms, and will be washed off by the first light rain. This characteristic of the cabbage and cauliflower foliage, with the overlapping broods of both cabbage worm and cabbage looper and the retiring habit, activity and careful feeding of the latter, make it necessary in working against them to select an insecticide that will “stay where it is put” and that will carry sufficient poison to kill the loopers, even though they eat but a small quantity. The applications must be made so thoroughly that every spot of surface will be protected and the treatment repeated, at least once, to insure destruction of the newly hatched worms.

The Best Poison Carrier.—After repeated tests an excellent material for securing uniform distribution and perfect adhesion has been found in a resin-lime mixture. In preparing this mixture it is necessary to make a stock solution from the following formula:

Pulverized resin	5 lbs.
Concentrated lye	1 lb.
Fish oil, or any cheap animal oil except tallow		1 pt.
Water	5 gals.

Place oil, resin and a gallon of water in an iron kettle and heat until resin is softened; add lye solution made as for hard soap; stir thoroughly; add remainder of water and boil about two hours, or until the mixture will unite with cold water, making a clear, amber-colored liquid. If the mixture has boiled away too much, add sufficient boiling water to make five gallons.

For use, one gallon of this stock solution is diluted with sixteen gallons of water and afterward three gallons of milk-of-lime or whitewash added. The resin mixture is in reality a liquid soap, and the addition of the lime turns it to a hard soap which remains suspended in the water in minute particles. The poison, one-fourth pound of Paris green or other arsenite, is then added, and the particles of poison adhere to the finely divided soap particles and are thus distributed throughout the mixture in minute and uniform quantities. The soap solution is very adhesive and thus a thin film of poison is made to stick to every part of the leaf which is touched by the spray. The application must be made by a hand power machine, either a strongly-made knapsack, or a barrel sprayer, as no horse power machine will do the work thoroughly enough or carefully enough upon cabbage and cauliflower.

Early Tests.—This resin-lime mixture received its first test upon cabbages in 1896, though it was used with perfect success against cabbage worms upon smooth-leaved turnips in 1895. Not a living worm could be found upon the patch three days after the spraying, and the protection was excellent, even to the end of the season, notwithstanding heavy rains.

On Cabbage.—In subsequent tests upon cabbage, the mixture with Paris green was used upon one farm in comparison with Bordeaux mixture, Bordeaux mixture and Paris green, Paris green and resin mixture without lime and with an application of salt; and upon another farm with Bordeaux mixture and with an application of Paris green and flour. The cabbages were sprayed twice, once late in August and again about eighteen days later. The results were surprisingly in favor of the resin mixture and Paris green. This, on all plats, was perfectly effective against the cabbage worms and only slightly less so against the cabbage loopers. The Bordeaux mixture, even when united with Paris green, and the flour and Paris green were of little advantage so far as the loopers were concerned, although quite destructive to the cabbage worms. The loopers evidently were able to avoid the spots poisoned by the dry powder and to find plenty of food which the poison had not touched or from which it had been blown. The salt was of no value whatever, as it only caused the worms to leave the cabbages and to pupate a little earlier than they would naturally do. It was estimated by the owner that the plats treated with the poisoned resin mixture yielded 100 per cent. better than the untreated plats and at least 60 per cent. better than those powdered with Paris green and flour.

On Cauliflower.—The tests on cauliflower have not been as thorough nor the results as marked. The erect, crowded position of the leaves of the cauliflower makes it difficult to secure a perfect film of the mixture on the entire surface; and the mixture must not be applied after the "flower" is exposed

lest there be danger of poisoning the human, as well as the insect, consumer. Yet the owner of the fields upon which the tests have been made says, "I am satisfied that it would have paid me to spray the entire field."*

Cost of Treatment.—To make two applications upon ten acres of late cabbage after the plants are two-thirds grown would require materials worth \$5.00, time in preparing stock solution, 75 cents, and ten days' labor, which at \$1.50 a day would be \$15.00, a total of \$20.75, or about \$2.00 per acre.

Precautions.—As noted before, a strong, well made knapsack sprayer must be used, as the mixture is liable to clog valves and nozzles and cause severe straining of a light sprayer. The workman must be close to his work and must thoroughly coat every leaf, both upper and under surface. There is but very slight danger of poisoning cabbage with the mixture, as only the outer leaves are touched by the spray and these are thrown away in preparation for the table. Cauliflower must not be sprayed after the "flower" is exposed. Only careful workmen should be trusted to make the late spraying upon the cauliflower, and all heads should be passed over that are too far advanced.†

*In addition it has been found that in using the resin-lime solution upon rapidly growing cauliflower warty excrescences are formed upon the leaves, thus indicating a slight injury. Hence for cauliflower it is more safe to use only half the quantity of resin solution and lime.

†*Other Measures.*—Since the above was published, it has been found that the new arsenate—arsenate of lead—is much easier to prepare and apply, and if care is used to apply it lightly and in a perfect mist while the plants are dry, it will be evenly distributed and when once dry will adhere nearly as well as the resin-lime solution. It has the further advantage of never injuring the plants. Many growers practice the use of dry Paris green applied by means of blowers or powder guns. Frequently the Paris green is diluted with flour or with airslaked lime, using ten or fifteen parts of the flour to one of the arsenate. This answers fairly well, if applied while the plants are covered with a light dew, but a light rain or a heavy dew soon washes it into the folds of the leaves, with the result of burning. Furthermore this method is of little value in controlling the cabbage looper.

Conclusions.—It seems firmly established (1) that resin-lime mixture and Paris green, thoroughly and carefully applied when plants are one-third grown and again just before the heads are formed, will almost wholly prevent damage to late cabbage and cauliflower; (2) that the expense need not exceed \$2.00 per acre, and (3) that there need be no danger to the consumer from such treatment.

THE CABBAGE PLUTELLA.

This moth has been described under the following names: "The Web Moth," "the Cabbage Leaf-miner," "the Diamond-back Turnip Moth," "the Diamond-back Cabbage Moth," "the Diamond-back Moth," and "the European Cabbage Web Moth." The caterpillar is a pale green worm about one-fourth inch long, with stiff dark hairs scattered over the body. It is usually found hidden under a web. If touched it will fall a short distance and hang by a delicate silken thread. When feeding it usually leaves its web, especially when nearly full grown. When full grown, the larva spins a thin cocoon in a fold on either side of the leaf. The moth is rarely seen except when frightened from its hiding place. Thorough treatment with arsenites for the cabbage butterfly will prevent any unusual outbreak of the plutella.

THE ZEBRA CATERPILLAR.

Though rarely occurring in injurious numbers, this pest sometimes attacks late cabbages and other Brassicas. It is easily distinguished by its velvety

black color, tawny red head and legs, and two yellow lines along each side of the body; between which are many irregular white zebra-like lines. When full grown it is two inches long. It is three-brooded and passes the winter in the pupa state. It feeds indiscriminately on quite a number of plants. The

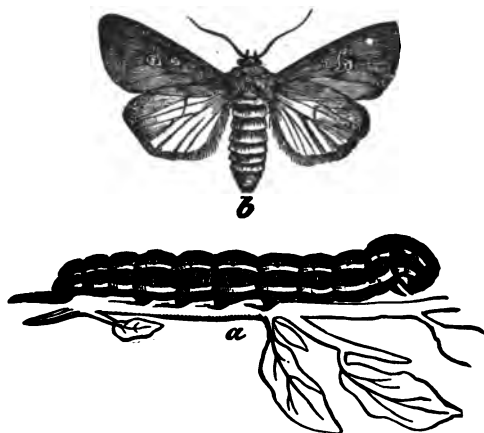


Fig. 17—Zebra Caterpillar and Moth.

larva is seen in Fig. 17, at *a*, and the fully grown moth at *b*.

When young the larvæ are congregated upon a few leaves and may easily be checked by hand picking. Later they can be destroyed by the application of hot water, insect powder, or kerosene emulsion or by use of the arsenites.

CUTWORMS.

There are a number of species of cutworms, nearly all of which, however, are similar in habits

and history, and the methods of destroying them are the same. Professor C. M. Weed recommends: (1) The killing of the worms before the crops are planted by strewing over the soil bunches of fresh clover, or cabbage leaves, which have been treated with Paris green, or London purple, either by dipping into a solution of the poison, or dusting it on dry. The half grown worms prowling about in search of food eat of the baits thus set and are destroyed before doing any harm. Of course care must be taken that poultry or stock do not get at the poisoned leaves.* (2) Placing boards on the ground in and about the garden or field, and collecting in the morning the worms that will congregate beneath them during the night. (3) Digging out the worms where plants have been cut off. This is practicable in most cases, and is well worth doing, thus preventing further damage.

THE CABBAGE ROOT MAGGOT.

The presence of this pest, when it occurs in considerable abundance, is indicated by a checking of the growth of the plant, a tendency to wilt badly under a hot sun, and a sickly bluish cast of the foliage. On pulling the wilted plant, most of the roots will be found to have been eaten, and the remainder in a decaying condition. The adults are small, black, two-winged flies resembling the common house fly. They appear in early spring and deposit their eggs in crevices of the soil close to their

*A mixture of equal parts of bran and middlings, twelve or fifteen pounds mixed with one pound of Paris green, answers as well for a bait as poisoned leaves. This can be used dry or wet.

food plants and often upon the plants themselves. In a short time these hatch into maggots, which at once attack the roots. The maggots become fully grown in three or four weeks, when they leave the roots, and transform to pupæ. The adults emerge from the puparia usually in from fifteen to twenty days.

The best (or one of the best) method of preventing the work of the cabbage maggot, or to protect from the maggot is to plant cabbages and allied vegetables in a new place each year, as far removed from the ground on which they were raised the preceding year as possible. The best insecticide for this pest is an emulsion of carbolic acid, employed to the roots of the plants. The best mechanical device for preventing their work is tarred paper disks placed about the plants.

THE HARLEQUIN CABBAGE BUG.

The harlequin cabbage bug, or calico back, is an oval, somewhat flattened black bug, with bright red and yellow markings arranged as seen in Fig. 18, *a, b*, showing young bugs; *c, d, e*, eggs; *f, g*, adult, natural size. It lives all the year round in the more southern United States upon cabbage, mustard, radish, and cruciferous plants, puncturing the leaves with its beak, and causing them to wither and dry.

This insect was originally an inhabitant of Mexico and Central America. It appeared in Texas in 1866, and gradually spread, from year to year, to the north and east. The eggs are about one-

twentieth of an inch long, and are usually deposited in two parallel rows of about half a dozen each. The eggs hatch on the third or fourth day after laying, and the young bugs go through all their molts and are ready for reproduction in about two weeks. There are many generations in the course of the summer. On the advent of winter the adult insects crawl away under any kind of rubbish to hibernate, reappearing in the spring and flying to the first cruciferous plants which come from the ground.

According to Professor H. E. Weed of the Mississippi experiment station, there is but one effi-

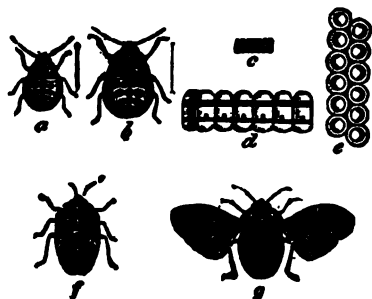


Fig. 18—Harlequin Cabbage Bug.

cient remedy for this insect, which is to destroy the brood that lives over winter when they congregate upon mustard and radish plants. Here they can be destroyed very easily by the application of kerosene by means of a common water bucket or sprinkler. If the insects are thus destroyed early in the season it will wholly prevent injury later. The mustard or radishes should be planted in the cabbage field. The bugs will congregate on these plants, and may be killed by applying kerosene, as mentioned. The

bugs will not injure the cabbage as long as there are mustard or radish tops for them to eat.

THE CABBAGE APHIS.

Next to the imported cabbage worm, this species is perhaps the most injurious insect enemy of the cabbage. Nearly as many remedies have been recommended for this pest as for the European cabbage worm. It should be remembered that plant lice are only killed by insecticides which smother or kill by contact. None of the poisons will kill them. The best remedy for outdoor purposes is kerosene emulsion diluted with ten parts water. It should be applied to the lower as well as the upper sides of the leaves, and, if possible, while the cabbage are small. In a number of tests of Pyrethrum, or Buhach, Persian insect powder and tobacco dust, tobacco was found to be the most active killing agent. Pyrethrum and Persian insect powder are considered good, but are liable to be adulterated and to lose their strength.

FUNGIOUS DISEASES.

CLUB ROOT.

The injury to the cabbage and turnip crops attacked by club root may be considerable, sometimes incurring almost a total loss, and in the aggregate the destruction for the whole country is doubtless represented by millions of dollars. It is particularly severe in the eastern portion of the United States, but is not unknown in the west and south. The following excellent account of this pest was given by Dr. B. D. Halsted, botanist of the New Jersey experiment station, in the columns of the *American Agriculturist*:

The Nature of Club Root.—In order that the reader may derive the most practical good from any suggestions as to use of preventives, and other treatment of the disease, it is best to place before him the facts thus far obtained concerning club root. The name of the malady is quite descriptive, for it is an affection of the roots, which become much distorted. The roots may begin to show enlargements while they are quite small and before the plants are more than seedlings. Thus cabbages while growing in the hotbed may show unmistakable signs of "clubbing," followed by a loss of vitality throughout the whole plant. The affected parts soon begin to decay, becoming very offensive, and, from places near by, other roots are

developed which, in turn, become swollen and distorted into various shapes. Of the most interest in this connection is the cause of the peculiar development and consequent destruction of the infested plants. As in nearly all instances of similar abnormal structures, these root galls were long ago assigned to insects. A careful study of their development failed, however, to convict any species or group of insects of these depredations, and after much speculation, and no end of articles in the agricultural journals and elsewhere, it was reserved for M. Woronin, a European botanist, after three years of painstaking and exhaustive study, to explain the nature of the subject before us. Instead of any insects being the cause, although such decaying masses usually become the breeding places for them, Woronin found that a low form of fungus was constantly present in the affected parts. This parasitic organism is only seen with the higher powers of the compound microscope. The family of fungi to which it belongs, namely, the slime molds, is widely distinct from the mildews, rusts and smuts. The life of the obscure club root parasite has been traced from its appearance in the root as a slime in certain cells to the formation of multitudes of spores in these same cells. By the decay of the roots, which takes place rapidly, and with much offensive odor, the spores are set free in the soil. These spores there germinate by producing moving bodies capable of penetrating, or being absorbed by the thin walls of the hairs and other superficial cells of the roots. The soil becomes diseased in the sense that the germs, formed in the swellings and other distortions of the roots, are set free, and the earth holds them for an

indefinite length of time. Fig. 19 shows three small badly "clubbed" cabbage plants half natural size; Fig. 20 are young turnips similarly ruined, while

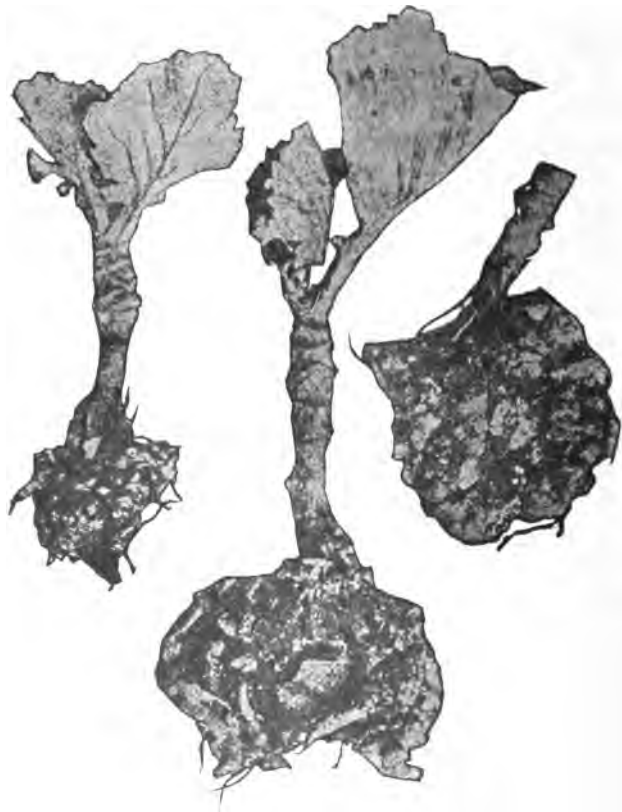


Fig. 19—Club Root of Cabbage.

affected cauliflower plants are shown in Fig. 21. These engravings are all from photographs of freshly collected plants, and are not the worst specimens of the malady that might have been selected.

Brussels sprouts and kale were found equally badly diseased.



Fig. 20—Club Root of Turnip.

Club Root in Weeds.—In addition to the plants above named the club root fungus (*Plasmodiophora*

Brassicae, Wor.) infests the cultivated stock, and candytuft, but in this country to no alarming extent. In this connection it is, however, interesting to add



Fig. 21—Club Root of Cauliflower.

two genera of weeds upon species of which the galls of slime molds have been recently found in abundance, namely, the shepherd's purse and hedge mustard. Fig. 22 shows a group of the infested roots

of the shepherd's purse reproduced natural size. The reader needs to bear in mind that these roots



Fig. 22—Club Root of Shepherd's Purse.

are neither large nor fleshy, and the galls are correspondingly small. The enlargement is usually just below the crown, but other parts of the root system

may be affected. In Fig. 23 is shown a similar group of the diseased roots of the hedge mustard. Here the galls are nearer hemispherical and may be

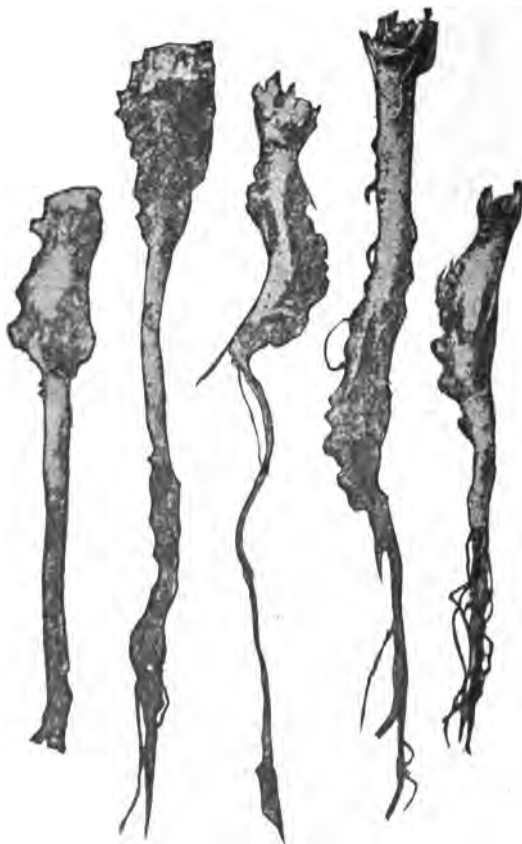


Fig. 23—Club Root of Hedge Mustard.

expected at any place upon the roots. These weeds bearing the club root were found in the vicinity of infested fields of cabbage and turnip, and help to

account for the latter, as such weeds growing in waste land serve to keep up continuous germs of the disease.

Precautions and Treatment.—From a consideration of the nature of the club root fungus and a knowledge of the different kinds of plants infested by it, there may be some suggestions gathered as to preventive measures. When it is understood that the club root and all the injury to the crop accompanying it is due to an internal subterranean parasite, it becomes evident that no treatment to which the infested plant may be subjected can give promise of a cure. Preventive measures must be relied upon, and, in the first place, all the refuse of a cabbage, turnip or other infested crop should be removed from the soil and burned. To leave cabbage stumps in the field, to feed them to live stock, or to throw them in the compost heaps, are three of the worst methods of propagating and spreading the malady on the farm. It is not enough to destroy the roots, for the *Plasmodiophora* is found also in the leaves and stems of infested plants. Seedlings of cruciferous plants grown in the hotbed should be examined carefully, and, if they show signs of the club root, consigned to the fire. If only a few portions of the plants are clubbed, it may be wise to discard the whole lot rather than lose the crop in the field. Start with healthy plants. In view of the fact that the soil may become more or less impregnated with the germs during the growth of a crop susceptible to the *Plasmodiophora*, it is evident that a wise precaution consists in a judicious rotation of crops. Just what that rotation should be, is a question for each grower to decide for himself, but, for the best results, cab-

bagés, or any allied crop, should not be upon the soil oftener than once in three years. Cabbage, kale, Brussels sprouts, kohl-rabi, turnips or radishes should not follow each other, if club root is prevalent in the ground.

It is possible to get relief by the use of some of the commercial fertilizers; but this needs confirmation through trial. It is a fact that is being acted upon in some of the large truck regions near New York, that lime is an effective preventive of the club root, and, by its constant use, at the rate of seventy-five bushels or so per acre each year, cabbages have been grown at frequent intervals almost yearly upon the same soil. It is likely that a soil naturally abounding in lime may be the best suited for cruciferous crops, so far as club root is concerned. Lastly, it has been shown that common cruciferous weeds harbor the fungus enemy, and, while the farmer may be thankful for the loss of his hedge mustard and shepherd's purse, through "clubbing," this is a case where such weeds can be more cheaply destroyed in some other way.

In a special bulletin of the New Jersey agricultural experiment station, Dr. Halsted summarizes the conclusions derived from the latest experiments and investigations as follows:

Thirty-five to fifty bushels of air-slaked lime, when applied to the surface of the soil, preferably the preceding season, and worked in, is a practical remedy for club root.

Gas lime, kainit, wood ashes, copper sulphate, corrosive sublimate, salt, sulphur, calcium carbonate and sodium carbonate have all proved unsatisfactory as remedies for club root.

Variety tests show that round turnips growing well out of the soil are much less susceptible to the disease than those varieties which run deeply and are much branched.

Irrigation favors the development of the club root. Buckwheat seems to have a wholesome effect upon land infested with the club root germs, but further tests are needed to warrant conclusions.

Shading has very little effect upon the activity of the *Plasmodiophora*.

Many kinds of plants may be infested with the disease, but none outside of the mustard family were found susceptible.

The club root germs will remain alive for a long time in the soil.

Soil may be inoculated by using infested cabbage or turnips, either applied directly to the soil or by using the manure from animals to which the club root cabbages or turnips have been fed.

Winter ridging of the infested land decreases the disease in the following crop, but only to a limited extent.

BLACK ROT.*

A great many parasitic diseases of plants have been known for many years, but now and then an apparently new malady makes its appearance, sweeping through sections of country, leaving devastated fields in its wake. Such is the case with the cabbage rot, a disease whose nature has not hitherto been thoroughly recognized, but one which has made

*Condensed from Bulletin No. 66 of the Vermont Experiment Station, by Professor L. R. Jones; and from Bulletin No. 65 of the Wisconsin Experiment Station, by Professor H. L. Russell, from which the illustrations used were reproduced

serious inroads in different localities. Fig. 24 shows a field of cabbage in Racine, Wisconsin, devastated by the rot, from which not a single head was harvested.

While the disease is more important in its relation to cabbage culture, on account of the relative amount of this crop grown, it also affects a number of allied species that belong to the same genus.



Fig. 24—Cabbage Field Destroyed by the Rot.

Besides cabbage and cauliflower, kohl-rabi, kale, Brussels sprouts, broccoli and collards are attacked by it, and to a lesser extent it develops in turnips, rutabagas, winter radish and other closely related vegetables.

Symptoms and Cause.—The first indication of the disease is upon the outer leaves of the cabbage and cauliflower, which turn yellow and die in spots,

usually at or near the margin. Careful examination shows that the veins in the dead areas are blackened. These spots enlarge, following down the veins toward the stem. The disease upon reaching the stem may pass up or down it into other leaves,



Fig. 25—Diseased Cabbage Stem.

and once established there it rapidly spreads thus through the entire plant.

The germs which are the cause of the malady spread exclusively through the vessels or fibrous portions of the tissue. These invaded vessels turn black, and this striking discoloration is a valuable diagnostic feature of the disease which every cabbage grower should learn to recognize. Fig. 25 shows the black spots in the leaf scars. These spots

are a sure sign of the black rot, showing that the germs have already passed from the leaves into the stems.

If the stem of a healthy cabbage leaf be cut across, these vessels are seen forming faint yellowish spots in the interior, in marked contrast to the black spots seen in the badly diseased leaf. In case of

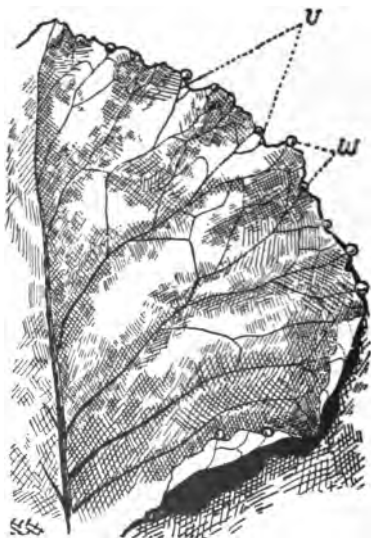


Fig. 26—Healthy Cabbage Leaf, Showing Water Beads Along the Margin.

leaves which are but partly diseased, only those vessels leading into the diseased areas will become blackened. Anyone seeing suspicious looking leaves on his cabbage plants may therefore readily satisfy himself as to whether it is this black rot, by cutting off the dying leaf stems and examining their freshly cut surface for these black dots. If it proves to be

this malady prompt measures should be taken to prevent its spread and also to lessen the chance of the permanent establishment of the germs in the soil. In order to do this intelligently one should understand how the disease spreads.

Mode of Spread.—If the leaves of a vigorous cabbage in moist soil be examined in the early morning tiny drops of water will often be found borne

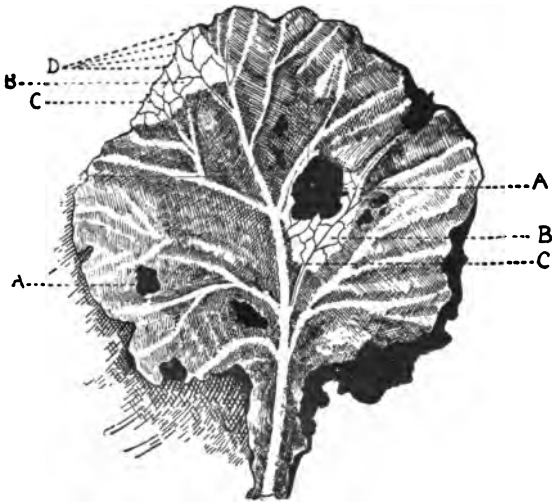


Fig. 27—Leaf in the Early Stages of the Rot.

upon the margin of the leaves, as seen at *w* in Fig. 26. These water beads have exuded from the interior of the leaf through the pores, which are exceptionally large at these points. The germs most commonly find entrance into the leaf by lodging in one of these water beads and thence passing through the pores into the veinlets, shown at *v*. In addition, they are doubtless often introduced and

spread by cabbage-eating insects which pass from the diseased to the healthy leaves. The manner of infection is shown in Fig. 27. The disease has invaded to areas which are left white in the illustration (B B), with the veins blackened (C C). In one case the germs entered through the water pores (D), in the other along the margins of the hole eaten by insects (A).

If rotting cabbage plants are left in the field, the germs pass the winter in the soil and reinfect cabbages, turnips or weed plants which may grow thereon the next season.

If fed to stock they pass into the manure and are similarly propagated in that way.

Remedial Measures.—Consideration of the above facts shows the need of the following preventive or remedial measures where the disease is observed:

Cabbages or turnips should not be planted a second year upon land where the disease is observed. In view of the dangers from this disease and club root, it is better in any case to rotate these crops with others. The seed bed also should be made in new soil each year.

Diseased cabbages should never be fed to animals uncooked. Manure from animals fed on garden refuse should not be used on soil intended for cabbages.

Keep the plants as free as possible from insects.

Where the disease has once appeared, the cabbage field should be watched, and during August and September should be systematically gone over and all leaves removed and destroyed as soon as they

show evidence of the disease. In case the germs have invaded the stem (as shown by the blackened vessels at the junction of diseased leaf and stem) the entire plant should be uprooted and destroyed. This destruction should be by fire or deep burial.

No plants of kale, wild mustard or other related weed which may harbor the disease should be allowed to grow in or near the cabbage field.

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